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Diminishing Manufacturing Sources and Material Shortages (DMSMS) Guidebook

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FOREWORD

This Department of Defense (DOD) Diminishing Manufacturing Sources and Material Shortages (DMSMS) Guidebook is a compilation of the best proactive practices from across DOD for managing the risk of obsolescence. With material extracted from various DOD DMSMS management documents, this DOD DMSMS Guidebook provides the Program Manager (PM) with a central repository of best practices. Additionally, it identifies assorted measurement tools that may be useful in analyzing and tracking the effectiveness of DMSMS Programs. This guidebook addresses both electrical and mechanical parts obsolescence issues. The PM should make this guidebook the desktop reference to quickly pinpoint key actions required in managing DMSMS issues and concerns. Additional information can be found at the DMSMS Knowledge Sharing Portal (DKSP), www.dmsms.org.

If you have any questions or comments about this document, please contact the Defense Standardization Program Office (DSPO), Attn: J-307, 8725 John J. Kingman Rd, Stop 6233, Fort Belvoir VA 22060-6221, or e-mail DSPO@dla.mil.

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1 INTRODUCTION

There are three goals for developing the DOD DMSMS Guidebook:

- To define a proactive DMSMS management process that can be used by a Program Manager (PM) to build an effective DMSMS Program.
- To define DMSMS support metrics to measure the effectiveness of a proactive DMSMS Program.
- To promote cost-effective supply chain management integrity through DMSMS problem resolution at the lowest (cost, time, functional) level.

An effective DMSMS process:

- Ensures that all parts and material to produce or repair the platform are available
- Reduces, or controls, Total Ownership Cost (TOC)
- Minimizes Total Life Cycle Systems Management (TLCSM) cost
- Eliminates, or at least minimizes, reactive DMSMS actions
- Evaluates design alternatives
- Provides for risk mitigation as it applies to DMSMS
- Evaluates more than one approach to resolve DMSMS issues
- Collects metrics to monitor process effectiveness

Common practices developed by various DOD organizations to achieve these goals and results are presented in this document for consideration. This Guidebook is not limited to any particular type or class of manufacturing sources and/or material shortages.

2 ENCOMPASSING TOTAL LIFE CYCLE SYSTEM MANAGEMENT (TLCSM) and PERFORMANCE BASED LOGISTICS (PBL) TENETS

The "DOD Template for Application of TLCSM and PBL in the Weapon System Life Cycle" stresses the tenets that emphasize an early focus on sustainment within the system life cycle. TLCSM is the implementation, management, and oversight, by the PM, of all activities associated with the acquisition, development, production, fielding, sustainment, and disposal of a DOD weapon system across its life cycle. It empowers the PM as the life cycle manager with full accountability and responsibility for system acquisition and follow-on sustainment. PBL is the preferred sustainment strategy for weapon system product support, and employs the purchase of support as an integrated, affordable performance package designed to optimize system readiness.

The Under Secretary of Defense for Acquisition, Technology and Logistics, has established six goals for the acquisition workforce to help exercise discipline in these processes and oversight that can avoid major surprises. They are:

1. Establish a high-performing, agile, and ethical workforce
2. Create strategic and tactical acquisition excellence
3. Focus technology on the warfighting needs by
    a. better integrating the views of the combatant commanders into the process
    b. defining the strategic technology vectors of the next era of competition
4. Bring cost effective joint logistics support for the warfighter
5. Create reliable and cost-effective industrial capabilities sufficient to meet strategic objectives
6. Implement improved governance and decision processes

Goals #4 and #5 relate directly to DMSMS efforts. An efficient, proactive DMSMS management process is critical to providing more effective, affordable, and operational systems by proactively identifying and mitigating DMSMS issues that affect their availability and supportability. This is in line with the TLCSM and PBL tenets. PBL offers an effective way to deal with obsolescence throughout the life of a product. Unlike traditional approaches to modernizing legacy systems, PBL holistically manages the product support of weapon systems, assemblies, subassemblies, and components. As the point of responsibility for meeting performance requirements, as outlined in the Performance Based Agreement, shifts to the Product Support Integrator (PSI) under the Program Manager, PBL provides a powerful tool for mitigating obsolescence and making continuous modernization (CM) a reality for current weapon systems, assemblies, sub-assemblies, and components (where a PBL application is feasible).

PBL clearly fulfills the need for CM and obsolescence mitigation. With PBL, the PM purchases performance via an integrated product support package rather than the parts or products themselves. This can be a long-term contract, or memorandum of agreement (MOA), with an organic support source or a commercial contract source. The nature of the award is based upon the performance guarantees that ensure a system is truly and effectively supported. On contracts that execute a PBL strategy, PMs are encouraged to

have commercial providers (via contract instruments) maintain a proactive DMSMS Program. Ideally, PBL contracts are long-term (5-15 years), and require that the provider manages many aspects of product support through the life cycle. As such, the properly structured PBL strategy will include an incentive for the provider to be proactive and manage DMSMS and obsolescence in order to achieve the required performance outcome(s). These long-term PBL agreements/contracts lower provider risk and allow for DMSMS mitigation efforts: life-of-type buys, long-term contracts with primes, long-term contracts between primes and subcontractors, and return on investment for redesigns. Additionally, a PBL provider may be able to leverage off of their commercial divisions and expertise. The PBL supplier has the financial incentive to continuously improve performance because it has a bottom-line impact:

a. Optimized supply support reduces inventory investment and yields higher margins
b. Increased reliability of systems and subsystems (and fewer failures or returns) reduces transportation, labor, and spare parts cost
c. The adoption of open system design increases the use of plug-and-play components that can be renewed or replaced quickly
d. Continuous modernization extends the system's useful life
e. Continuously refreshed technologies increase the residual value of the systems, subsystems, components, and repair parts. [1]

In addition, two key PBL documents with which every DMSMS manager should be familiar are:

a. "Performance Based Logistics: A Program Manager's Product Support Guide", dated March 05. [1]
b. "Designing and Assessing Supportability in DOD Weapon Systems: A Guide to Increased Reliability and Reduced Logistics Footprint" dated 24 Oct 03. [2]

In addition, MIL-HDBK-512, "Parts Management", dated 31 Oct 01, provides process guidance for performance based parts management in the preparation of Requests for Proposals (RFPs) with respect to a parts management program. It will help determine to what extent parts management should be implemented for a given program and help identify those elements in a proposal to manage the selection and use of parts. It stresses that procedures for obsolescence management should be addressed to include proactive obsolescence forecasting for applicable part types (e.g., microcircuits) and plans for reacting and achieving solutions to obsolescence impacts as they occur and affect the program. This DMSMS risk mitigation is one facet of the larger process of parts management. The document is available at http://www.dscc.dla.mil/Programs/mil512/ .[3] (Note: if hyperlinks do not connect, try a "copy and paste" of the URL into your web browser.)

Another PBL consideration is Air Force Instruction 63-1201, 1 February 2000, "Assurance of Operational Safety, Suitability, & Effectiveness (OSS&E)", which implements AFPD 63-12, Assurance of Operational Safety, Suitability, & Effectiveness.

It defines a process for establishing and preserving the safety, suitability, and effectiveness of Air Force systems and end-items over their entire operational life. The OSS&E program places strong emphasis on risk management and configuration management and therefore attaches significance to DMSMS problems that can affect both areas. This policy requires any selected DMSMS resolution alternative, other than identical items from an approved source, be approved by the chief/lead engineer. OSS&E baselines must be considered when making PBL decisions on Air Force weapon systems.

The TLCSM approach increases the significance of design for system Reliability, Availability, Maintainability, Manufacturability, and Supportability. The inherent objective of TLSCM is to enhance the warfighter's capability through improved System Operational Effectiveness (SOE) of new and fielded weapon systems. SOE is a composite of performance, availability, process efficiency, and total ownership cost. The objectives of the SOE concept can best be achieved through influencing early design and architecture. The warfighter's capabilities are maintained by focusing on System Design for Operational Effectiveness (SDOE) through the DMSMS application of cost-effective Lean Six-Sigma principles. Reliability, reduced logistics footprint, and reduced system life cycle cost/TOC are most effectively achieved when they are included as drivers from the very beginning of a program – starting with the definition of required capabilities. Reliability, maintainability, supportability, and produceability are components that impact availability. The primary objective of "design for system supportability" is to positively impact and reduce the requirements for the various elements of logistics support during the system operations and maintenance phase. One aspect of successfully accomplishing this is by continually addressing issues pertaining to DMSMS.[2]

Open system design helps mitigate the risks associated with technology obsolescence. Being locked into proprietary technology or relying on a single source of supply (SOS) over the life of a system can be detrimental to the warfighter's mission. Spiral development can also help to alleviate obsolescence concerns. However, the PM must ensure that PBL product support efforts include an active and proactive DMSMS process to anticipate occurrences and take appropriate action. This includes Bill Of Material (BOM) development and quarterly CM updates to the PM. When a PBL contract is used, the PM shall ensure the contract stipulates that all configuration management data be turned over to the Government. The Product Support Integrator (PSI) can help carry this out.[3, 1] The PSI is an entity performing as a formally bound agent (e.g. contract, MOA, MOU) charged with integrating all sources of support, public and private, defined within the scope of the Performance Based Logistics agreements to achieve the documented outcomes. PBL support arrangements give significant latitude to the PSI to manage technology refreshment. The PSI has responsibility for performance outcomes and is incentivized to maintain currency with state-of-the-art technology, maximize the use of Commercial Off-the-Shelf (COTS) items, and generally use readily available items to avoid the high cost of DMSMS over the life of the system[4]. Actively addressing DMSMS concerns throughout the entire life of the program will help ensure effective life cycle support and reduce adverse impacts on readiness or mission capability.

Appendix B provides examples of contract language that have proven useful in implementing DMSMS programs.

3 ESTABLISHING A DMSMS PROGRAM

3.1 Determining Level of Involvement

DMSMS is the loss, or impending loss, of manufacturers of items or suppliers of items or raw materials. The military loses a manufacturer when that manufacturer discontinues (or plans to discontinue) production of needed components or raw materials. This situation may cause material shortages that endanger the life cycle support and capability of the weapon system or equipment. An effective approach to such a pervasive problem hinges on being proactive. This provides the PM an opportunity to resolve obsolescence problems before they have an adverse impact on availability or TOC. In that regard, the DOD Components should proactively take timely and effective actions to identify and minimize the DMSMS impact on DOD acquisition and logistics support efforts. Military components can establish effective DMSMS programs that will reduce or eliminate the cost and schedule impacts of identified DMSMS problems. These actions should also ensure that these problems do not prevent weapon system readiness and performance goals from being met.[5] The seriousness of the problem demands a proactive, risk management type approach. The four basic steps of a proactive DMSMS risk management process are illustrated in Figure 3-1.

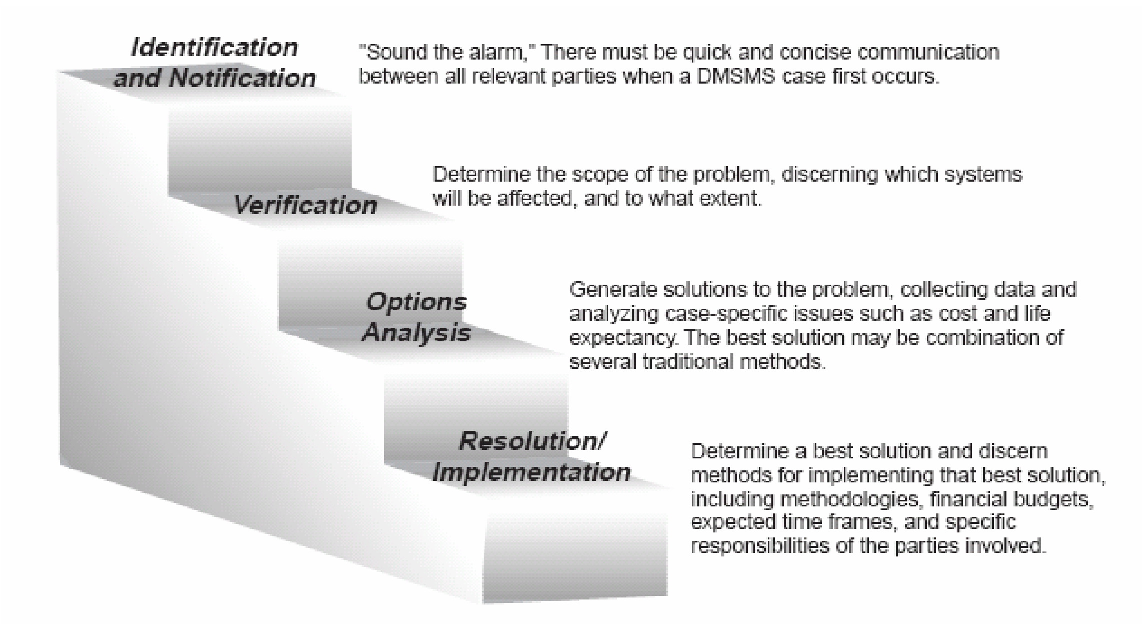


Figure 3-1. Four-Steps of DMSMS Risk Management Process [6]

Note: The DMSMS Program must be in place with interactive processes for even the first step to be realized.

In implementing a proactive DMSMS Program, the chart in Figure 3-2 presents a spectrum of possible DMSMS involvement. To address DMSMS risk, of course, the higher levels of involvement will go further to mitigate or avoid that risk.[6] Additional

risk management guidance is available in the DOD Risk Management Guide. Note that these four levels of involvement do not necessarily equate to the four-step risk management process discussed in section 3.1 or to the intensity levels discussed in section 3.1.1.

Reactive Reacting to consequences of risk.		**Proactive** The DMSMS team has a visible process of identifying, analyzing, and controlling risks that are measurable and repeatable.	
No Involvement	Low Involvement	Moderate Involvement	High Involvement
Doing nothing until the system functionality is impacted by a part that is no longer available	Focusing on the risk management process that accepts risk until being notified of a discontinuance, after which, a contingency plan is developed and employed to preclude impact to the weapon system mission capability	Mitigating risks by actively taking steps on parts that appear to offer more risk exposure (combination of high probability and significant impact). Examples of this approach include use of hierarchical/ indentured databases describing the weapon system	Agency takes steps to avoid the risk (e.g., Use of Open Systems Architecture, Scheduled Technology Replacement, and VHDL)

Figure 3-2. DMSMS Risk Management Practices [6]

3.1.1 Implementation Intensity Levels

3.1.1.1. Intensity Levels Defined. There are four intensity levels of common practices influenced by the resources available to manage DMSMS. These include practices that could be implemented to mitigate the effect of DMSMS and are defined as:

a. Level 1: Practices implemented to resolve current obsolescence problems. Some of these activities may be considered reactive.

b. Level 2: Minimal required practices necessary to mitigate the risk of future obsolete items. The majority of these activities are perceived as proactive.

c. Level 3: Advanced practices required to mitigate the risk of obsolescence when there is a high opportunity to enhance supportability or reduce total cost of ownership. These proactive activities may require additional program funding.

d. Level 3+: Proactive practices implemented during conceptual design and continuing through production and fielding of new start systems.

3.1.1.2. The Role of Proactive Management. The common practices in Table 3-1 anticipate future events and establish program elements to mitigate future problems. The practices associated with the above intensity levels form the basis of a possible DMSMS Management Program that can be used to mitigate the impact of DMSMS. Level 3+ is introduced to establish initial planning, preferably during the early stages of design, which will realize significant benefit to the fielded system for its expected lifetime. These proactive design and documentation practices will provide the most cost-effective, concise technical information required for long-term sustainment with the least cost.

Table 3-1. Common Practices to Mitigate DMSMS Effects[7]

Intensity Level 1	Intensity Level 2	Intensity Level 3	Intensity Level 3+
DMSMS Focal Point	Awareness Training	Circuit Design Guidelines	Technology Road Mapping
Awareness Briefing	DMSMS Prediction	VHDL [1]	Planned System Upgrades
Internal Communications	DMSMS Steering Group	Technology Assessment	Technology Insertion
External Communications	COTS List	EDI [2]	Technology Transparency
DMSMS Plan	DMSMS Solution Database	Technology Insertion	VHDL
Parts List Screening	Opportunity Index		Programmable Logic Devices
Parts List Monitoring	Website		
Resolution of Current Items	Operations Impact Analysis (OIA)		
Supportability Checklist			
Notes: 1. VHDL: Very High Speed Integrated Circuit (VHSIC) Hardware Definition Language 2. EDI: Electronic Data Interchange			

3.1.2 Selection of Practices

3.1.2.1 Trigger Events. The consideration and selection of DMSMS management practices usually follows an event that convinces the program manager that one or more practices need to be implemented. These events are called *triggers*. Qualitative triggers form the basis of the questionnaire shown in Table 3-2. To assess the situation, PMs should complete the questionnaire in Table 3-2. Quantitative triggers form the basis of the selection process shown in Figure 3-3. PMs who have been faced with a DMSMS problem may well want to use both the questionnaire and the selection process in Table 3-2 and Figure 3-3, respectively. Reactionary actions, based upon triggers, usually do not yield the best design, nor do they apply Lean Six-Sigma principles, thus resulting in a cost ineffective remedy. A proactive program uses DMSMS tools to evaluate parts data [Problem Parts List (PPL) and BOM], project potential issues and evaluate alternative solutions.

Table 3-2. Common Practices Selection Questionnaire [7]

Question Number	Question to Program Manager	If Yes, Review Intensity Level(s)
1	Is there an opportunity to enhance supportability or reduce TOC?	1, 2, and 3
2	Are you in the early stages of design?	3+
3	Has higher management (above PM) become aware of supportability problems?	1 and 2
4	Have you increased your awareness of DMSMS problems?	1
5	Have you recently become aware of DMSMS problems?	1

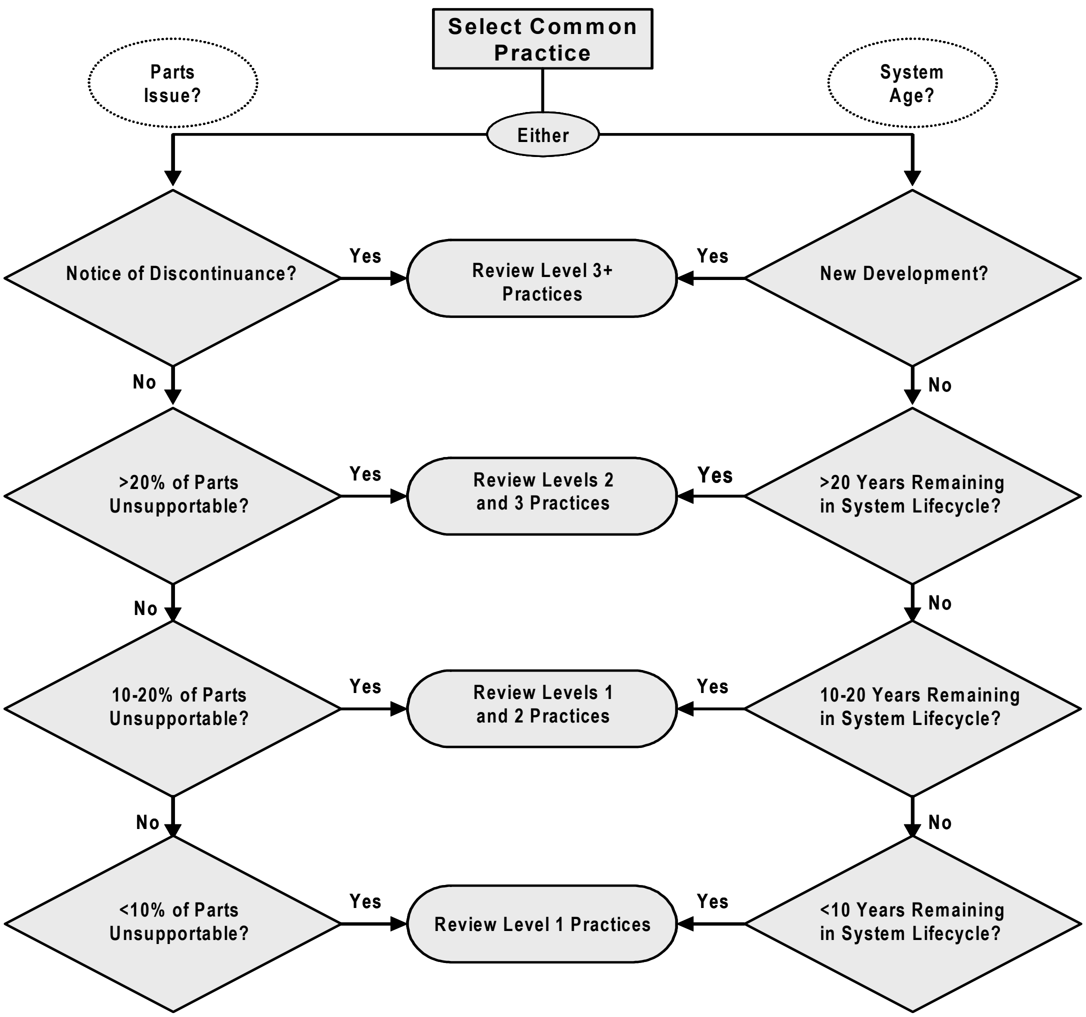


Figure 3-3. Selection Process When the Extent of DMSMS Problems is Known [7]

3.1.2.2. In addition to using the questionnaire in Table 3-2 and the selection process in Figure 3-3, the selection of the appropriate practices must also consider the complexity of the program, available resources, management philosophy, and the acquisition life cycle

phase. For example, a program entering the Technology Development phase may be able to plan for the incorporation of Level 3 practices in the System Development and Demonstration phase RFP. However, a program in the Operations and Support Phase may not be able to afford to convert all the drawings into an Electronic Data Interchange (EDI) format. The selection should also consider how a particular practice might affect:

- Unit production cost estimates
- Life-cycle cost estimates
- Cost performance versus schedule
- Acquisition strategy
- Affordability constraints
- Risk management
- Projected system availability
- Unit design
- Design interface

3.1.2.3. The collection of this information puts the PM in the best position to select the common practices most applicable to the program. PMs have realized a cost avoidance by implementing these practices and have "stepped up" their programs to reduce the risk of obsolescence. This concept is illustrated in Figure 3-4 below along with the possible "triggers" discussed earlier.

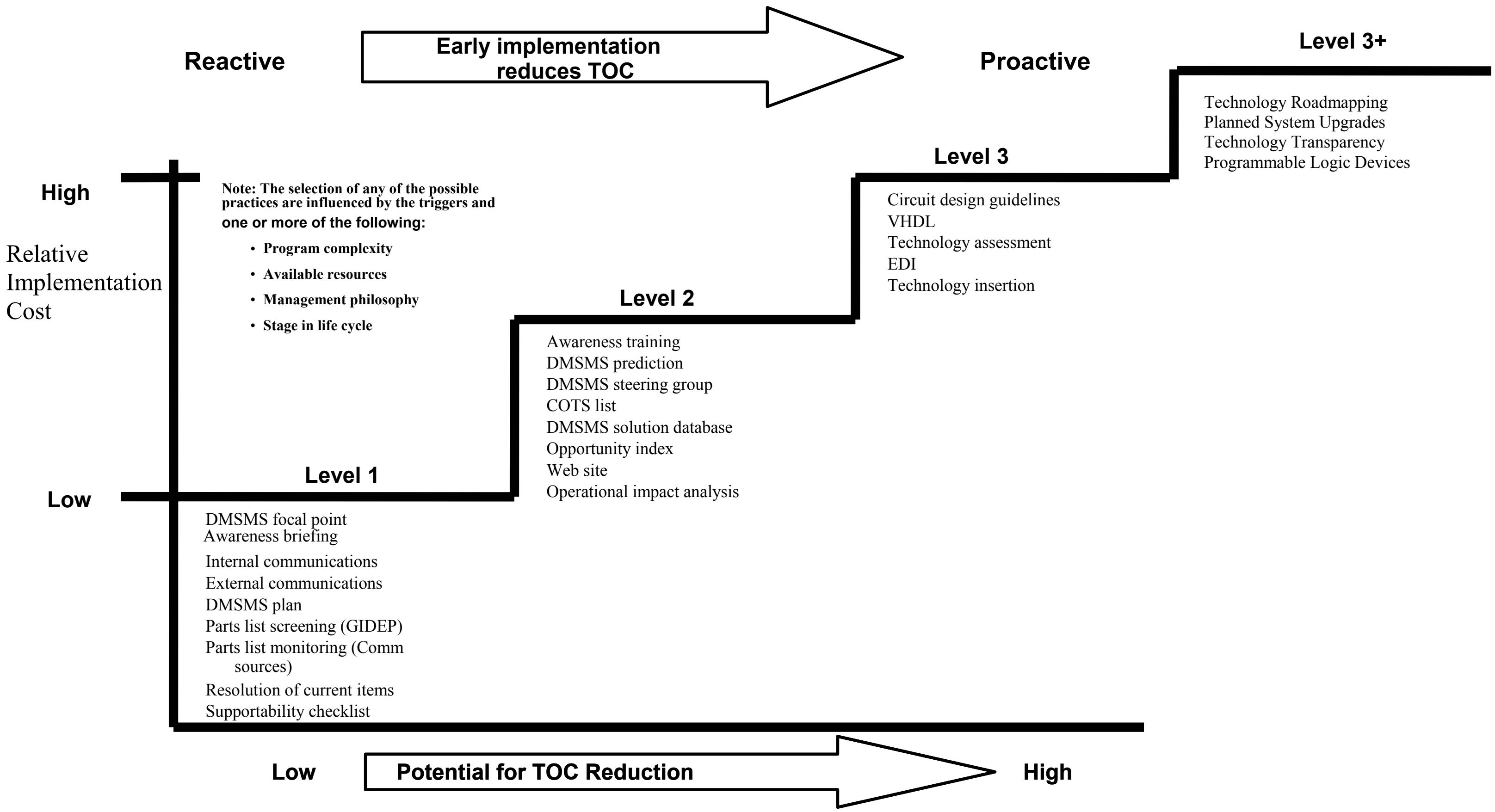


Figure 3-4. Using Higher Levels to Minimize the Risk of Obsolescence [7]

3.1.3 Expanded Discussion of the 3+ Level Approach

Level 3+ should include the practices at Level 3 plus the practices shown in Table 3-1. This level of activity will provide a tailored yet comprehensive program that meets the anticipated DMSMS risks.

3.1.3.1. The Customer's Perspective. The buyer's perspective on DMSMS management is usually "How do I protect myself?" While cost is a valid consideration, the focus must be on guarding against, or instituting proper planning mechanisms to address future DMSMS problems. A quick review of current DoD DMSMS management efforts reveals a wide range of activity. It ranges from no program DMSMS awareness to full proactive programs. The latter seems focused on problem resolutions and, for the most part, remains in the purview of the logistics team with little to no program management support. Level 1 and Level 2 DMSMS resolution practices are well understood and widely known, but are truly after-the-fact solutions. To implement Level 3 and Level 3+ practices, successful organizations will have to reach beyond DMSMS damage control and focus time, energy, and resources toward a proactive approach that ensures future problems are minimized, if not eliminated. Although the implementation cost will be high, the cost due to a failure to implement will likely be far greater. Note: It is important to monitor the health of any new systems (e.g., technology refresh/insertion) to proactively identify any part availability issues early in the acquisition process. A proactive solution provides better support to a program than a reactive trigger.

3.1.3.2. The Supplier's Perspective. The supplier's perspective on DMSMS management represents a dichotomy. "How do I do the right thing (add overhead cost) and maintain a competitive edge (lower overhead cost)?" The primary objectives of any commercial organization are to keep costs down and increase profits. It is clear that to implement Level 3+ DMSMS practices, the seller must expend time and manpower resources. The problem becomes one of helping the supplier's senior management accept that DMSMS avoidance management is good business. Accomplishing this objective requires two distinct approaches, both of which reach the same conclusion:

- Apply DMSMS avoidance techniques to products making them more attractive to buyers by reducing projected TOC.

- Develop a DMSMS awareness organization as a defensive strategy against competition, paving the way for increased sales and profits.

3.1.3.3. Implication for Source Selection. While the customer is concerned with initial acquisition cost and TOC, the supplier generally does not need to deal with the long-term storage/warehousing costs associated with post-deployment sustainment. However, he is concerned with the perception of higher acquisition cost introduced by DMSMS avoidance costs. This means that projected TOC and DMSMS mitigation cost should be evaluation factors in the Source Selection process. This will provide an incentive for the seller to spend money upfront in development and production. In turn, this ensures both

long-term savings and supportability of the equipment. This approach will require both the buyer and the seller to accept the basic one-time costs associated with implementing Level 3 practices, and to recognize that implementing these practices during the life cycle should lower the projected and actual TOC. Of course, it can be expected that designing-in DMSMS avoidance is a cost driver; however, two other potential offsetting results are:

- Increased sales for the seller
- Decreased TOC for the buyer

3.1.3.4 Summary of DMSMS Triggers and Practices. The table below provides a summary of the triggers and the practices to implement.[7]

Table 3-3. Summary of DMSMS Triggers and Practices [7]

Level	**Trigger** **If any of these triggers or events occur…**	**Practice** **… implement any of these practices**
1	Initial DMSMS awareness by PM <10% of parts unsupportable <10 years remaining in system life cycle	DMSMS Focal Point Awareness Briefing Internal Communications External Communications DMSMS Plan Parts List Screening Parts List Monitoring Resolution of Current Items Supportability Checklist
2	Increased awareness from PM 10–20% of parts unsupportable 10–20 years remaining in system life cycle Level 1 practices are not cost-effective	Awareness Training DMSMS Prediction DMSMS Steering Group COTS List DMSMS Solution Database Opportunity Index Website Operational Impact Analysis
3	Higher management (above PM) awareness of supportability problems >20% of parts unsupportable >20 years remaining in system life cycle Level 1 or 2 practices are not cost-effective. Opportunity to enhance supportability or reduce total cost of ownership	Circuit Design Guidelines VHDL Technology Assessment EDI Technology Insertion
3+	Level 1, 2 or 3 practices are not cost-effective. Opportunity to enhance supportability or reduce total cost of ownership	Technology Road Mapping Planned System Upgrades Technology Transparency VHDL Programmable Logic Devices

3.2 Key Program Elements to Consider

If a PM is establishing a new DMSMS Program, or "taking over" an existing one, there are some first actions and priority steps that should be considered. This section covers those actions and steps.

Section 6, References, lists key documents used in developing this Guidebook. The list contains hyperlinks to those documents. In addition to the local DMSMS representative, various websites, e.g. the DoD DMSMS Knowledge Sharing Portal (DKSP), are great places to start. The DKSP has helpful documents and training sections. See Section 3.2.5 for more information on the DKSP. One of the documents listed on the DKSP is the *DMSMS Fundamentals* course content document. This section contains key points taken from that document. The local DMSMS representative should be up to date on the requirements and may recommend some tools for assuring the successful implementation of a DMSMS Program.

After a few days of studying the material, the terminology and language will start to make sense. If the PMs have access to one of the programs discussed in the course book, or if they know of other proactive DMSMS Programs, they should observe an established DMSMS Management Program and sit in on its meetings and review their process.

3.2.1 Program Implementation

As with any project, good management is the key. This means solid planning for the DMSMS project, along with equipping and enabling your DMSMS Management Team (DMT) to work together. There are four primary keys to a successful proactive DMSMS Management Program. They are:

- Management "buy in" (i.e., commitment)
- Program centered around a team and predictive tool(s)
- An accurate BOM
- Financial resources

The active interest of senior leadership is vital to a successful DMSMS Program. The senior leadership's interest will ensure that the various supporting disciplines (e.g., Engineering, Logistics, Management, and Contracting) will render unified support of the coordinated and approved DMSMS Management Program.

Another aspect of involvement deals with the organizational level at which DMSMS should be managed. Efficiencies can be realized by monitoring DMSMS at the highest level of commonality. That means common items (those not unique to a system) should be managed at the DoD level in order to leverage volume, which in turn will lower unit cost and potentially extend the life cycle. This will also reduce redundancies in finding and fixing problems for like items. Beginning to manage DMSMS at any lower level

(e.g. Depot or Program) may prove sub-optimal. At the higher levels, the monitoring of problem parts and finding supply solutions to those problems becomes more effective.

The team that is put together and the predictive tool that they choose become the heart of a successful program. The PM must bring together representatives from the Program Office, Engineering, Logistics, the integrating Original Equipment Manufacturer (OEM), and any other organizational representative that will help manage the problem. Within the above organizations, the applicable skill types should include analysts, engineers, equipment specialists, logisticians, and item managers.

Most predictive tools perform the same core function and are currently limited to the analysis of electronic components. They monitor the status of components of the BOM. Each has a set of loading criteria and format, output report formats and other unique information that can be gleaned from the loaded BOM. The DMT should perform a review and work together to select the tool that is right for the program based on needs and cost.

The BOM is the key element that allows proactive DMSMS management. The DMT must have (or be able to obtain) accurate and complete configuration data (as defined by the OEM design data). They must know the piece parts and materials/chemicals that make up a system or Line Replaceable Unit (LRU) configuration (e.g., card, box, or subsystem) before they can identify the problem parts. If the DMT cannot obtain such data, they can only react to problems as they arise, and then the program must be designed for that mode. This reactive process is undesirable and it should be avoided. Program managers should consider requiring DMSMS forecasting source data in accordance with DI-SESS-81656 to identify, forecast, and manage piece part obsolescence impacts and mitigations as part of the contract data requirements. BOM development is discussed in greater detail in Section 3.3.

Few, if any, DMSMS Management Programs have implemented proactive solutions in their first or second year. One reason is that the military acquisition process requires projects to be budgeted for years in advance and funds are normally not available for DMSMS efforts unless appropriately earmarked beforehand. Developing a DMSMS budget is intuitive. Here are some suggestions depending on the maturity of the DMS Program.

> Initial Program – Use a spreadsheet to delineate annual personnel costs (both government staff and contractor support) to build a DMT and to cover travel, training, and any predictive or data tool costs.
>
> Established Program – Include the on-going costs for the resources required in establishing the initial program above. Added to that will be the cost of implementing the obsolescence resolutions submitted by the DMT. An effectual DMT will detail the cost to implement a specific resolution. This will not only aid in budget preparation but also in POM budget justification. The cost may be

distributed over several years and will be affected by administrative and production lead times.

Another reason solutions are not normally implemented in the first few years is that the resolutions (validating a substitute part or developing a new circuit card) must go through the contracting process (several months) and only then does the DMT start to actually solve the problem. The success of DMSMS should significantly reduce the need for emergency projects related to the sustainment and produceability of military weapons, systems, and commodities.

Assuming that the DMSMS Program is viable, there are steps and decisions that the DMT must make to get underway. Stripped to the basics, DMSMS risk mitigation is a management problem and can only be solved by discerning and careful management. This means planning, applying new (to the DMT) types of resources, and delegating too many specialists. The starting point is to think of the DMSMS picture as three program elements that will now be described.

3.2.2 DMSMS Management Program Elements

There are three elements common to many current DMSMS management ventures. The elements are Infrastructure, Operations, and Support. They must be well defined, integrated, and exercised. The DMSMS Program will evolve over time to adapt to the uniqueness of the platform and the DMSMS enterprise that the DMT has established. The definitions of these elements and the roles and responsibilities associated with them should be documented in the DMT Management Plan.

3.2.2.1 Infrastructure. This element refers to the set of enabling resources and capabilities for the program. The following paragraphs outline key program design decisions or selections and who will administer the DMSMS Management Program. Most successful programs have a strong Program Integrating Agent (PIA). The DMT typically has three choices for the PIA: the prime contractor, a support contractor, or organic internal resources. The PIA collects identified problems, and keeps the problem resolution process moving.

The DMT will need to choose a DMSMS predictive software tool to forecast the obsolescence of the electronic parts in the BOM. Several tools are available and include AVCOM®, Q-Star®, TACTRAC®, and Total Parts Plus® as commercial examples. Obsolescence Management Information Systems (OMIS) and Horizon Suites are government examples of software tools. Each one is different in the user interface, loading of data into the software, and interval of refreshing the data. OMIS uses inputs from Q-Star®, TACTRAC® and certain logistics databases to formulate a total life cycle management plan and budget. Another tool, ALARM®, calculates obsolescence risk based on associated DLA logistics and engineering data for both electrical and mechanical components. The DMT should compare the features and cost of all candidates – certainly, the people who will be using the tool (often a key role of the PIA) need to feel comfortable with the choice. After the decision, the predictive software tool

or service must be purchased (on a contract or subscription basis). Something to remember is that a proactive DMSMS Management Program is built on several factors, with a predictive tool being just one facet of that overall program. It is extremely important that the DMT not be misled into thinking that a specific "tool" alone would solve all DMSMS problems. Engineering analysis and judgment are still key factors in the final decision.

The DMT should develop a DMSMS Management Plan (DMP) for its program. The team will need to state the program objectives and compose a comprehensive list of DMT roles, responsibilities, program resources, and DMT procedures. The plan should have provisions to measure the progress and output of this program. The PIA should take a lead role in formulating this plan for DMT approval.

An automated DMP generator is in development to assist programs in creating DMPs. It utilizes the Logistics Planning and Requirements System (LOGPARS) expert system software to ensure that the latest policy and guidance is included to create high quality DMPs. The tool provides program executive offices the ability to customize their DMPs to meet the specific program needs. This is an effective way for programs to create DMPs. It will be available from the DMSMS Knowledge Sharing portal at www.dmsms.org.

In preparation for the inaugural meeting, the DMT will need a draft process flow and draft DMSMS Management Plan – especially an initial delineation of responsibilities. That meeting should also have demonstrations of the candidate predictive software tools and process outputs. In the first year, quarterly meetings will be needed to make real progress in ironing out the inevitable process problems.

In addition to the predictive tool, the DMT will use many data sources, some listed below, to identify problems and pursue solutions. Some of these data source tools will be purchased and some are free with government access permission. Table 3-4 lists some of these tools. This list does not constitute government endorsement. A more comprehensive list being established by the DMSMS WG Common Use Tool Committee, along with a detailed description of each tool, can be found at http://www.dmsms.org/.

Table 3-4. Potential Data Sources

Name	OPR[1]	Access	Fee	Registration Req'd	Usage
ALARM[2]	ARINC	Public			Analysis tool with COTS capability
CDMD-OA[3]	NAVSEA[4] (DETPAC)		No		Configuration status accounting of systems and equipment
D200C[5]	AFMC[6]	USAF-only	No	Yes	LRU and SRU failure data
EMall	DLA	All DoD	No	Yes	Item of supply information and ordering (DLA Item Catalog)
GIDEP[7] Notices	GIDEP	Public	No	Yes	Historical and new discontinuance notices pertaining to the platform
Haystack Gold	IHS Inc.[8]®	Public	Yes	Yes	Item identification data
Horizon Suites	NAVSEA	Navy, Potential DoD	Yes	Yes	Web-based DMSMS analysis tool set/service
JEDMICS[9]	AFMC	All DoD	No	Yes	Part identification and solution development
MEDALS[10]	DLA	All DoD	No	Yes	Engineering drawing location and revision
Microcircuit Query	DSCC[11]	Public	No	No	Mfg's part number to Std Microcircuit Drawings
OMIS[12]	NAVSEA	All DoD	Yes	Yes	Web-based system sustainment tool
PC Link	DLA	All DoD	No	Yes	Access to service databases
Q-STAR[13]	QinetiQ	All DoD	No	Yes	Web-based obsolescence tool
REMIS[14]	AFMC	USAF-only	No	Yes	Reliability data for special studies
SMART[15]	RAC Inc.				COTS LRU analysis tool
WebFLIS[16]	DLA	All DoD	No	Yes	Federal Total Item Record
WebLink[17]	DLA	All DoD	No	Yes	Web based version of PCLink

1 Office of Primary Responsibility
2 ARINC Logistics Assessment and Risk Management System
3 Configuration Data Manager's Database– Open Architecture
4 Naval Sea Systems Command
5 D200C – (USAF) Recoverable Item Requirements Computation System
6 Air Force Materiel Command
7 Government Industry Data Exchange Program
8 Information Handling System
9 Joint Engineering Data Management Information and Control System
10 Military Engineering Data Asset Location System
11 Defense Supply Center Columbus
12 Obsolescence Management Information System
13 QinetiQ's Sustainment Technology Assessment Resource
14 Reliability Engineering Management Information System
15 Supportability Management Assessment Report Tool
16 Federal Logistics Information System Web Inquiry
17 Web Logistics Information Network

The DMT needs a database to store its work. For the rare DMSMS Program with only a few DMSMS problems to work, the Problem Part Reports (PPRs), or other service equivalent problem identification methods, could perhaps be tracked on a spreadsheet. However, a proactive program (with its concurrent investigation of hundreds of problems underway at multiple locations) is different. The DMT will soon become overwhelmed with data and will need a DMT Database to generate the technical and management control reports. One of the crucial infrastructure elements is to develop this database or adapt one from a different DMSMS Program.

The DMT will need to prioritize what they will work first using a methodology that they will adopt or develop. The platform being worked may have many systems, each with multiple LRUs (boxes), which in turn have many more Shop Replaceable Units (SRUs) (boards). Since the DMT cannot work them all concurrently, there must be some method of prioritization. Look at other active DMSMS Programs and possibly adapt their prioritization methodology. For example,

- Window of opportunity – no point in looking at a lifetime buy when there are no more parts available.
- Operational impact – when will the program start hurting?
- Funding and business case analysis – when, where, and how do I get money?

After the DMT has selected a prioritization methodology, they must collect the input data required by the methodology, apply it to the list of systems, and rank order the systems in order of criticality. This methodology will also require the use of platform data (such as relative obsolescence and mission essentiality of the LRUs). Therefore, the approach must be based on easily available (yet meaningful) input data.

Collecting the configuration data and loading the predictive software tool is a continual process. The DMT must determine the configuration data sources (e.g., technical orders or engineering parts lists). They may need to convert paper data to a data file of indentured BOMs to load into the predictive software tool (by the tool contractor or the DMT). After this, the real magnitude of the current and future DMSMS problem on the platform will begin to surface. The DMT is now ready to start “operations” and to investigate the obsolete parts and apply the prioritization methodology to determine the most critical system or LRU.

3.2.2.2 Operations. This element is where the DMT applies the infrastructure sub-elements in accordance with their plan and procedures. Below are some important elements for the DMT to know:

Processing the initial and subsequent batches of PPRs will be a new workload and a challenge for the team. Motivating their involvement is crucial and requires strong endorsement by senior management.

Administering the decision-making process requires trained professionals. After the initial research (based on the predictive tool and the other data sources listed above), the

operations members of the DMT will release a batch of PPRs (IAW the priority list) to the DMT members for their expert review and recommendations. Normally this batch will go to DSCC first (for electronic parts), then to contractors, logistics centers, and the owning IPT. Essentially, the DMT will "grow" a solution. The DMT, or PIA, will need to check that the PPRs are being worked and not languishing in someone's inbox.

Understanding the costs of DMSMS management and measuring the success of a DMSMS Program call for the development of program metrics. This requires a PM to document recommended and approved solutions and monitor implementation. Generating and reviewing PPRs generates an ever-growing list of recommendations that require follow-up action. For example, if there were obsolescence problems on 14 circuit cards in a given LRU, there would be a mix of recommendations (each a mini-project) for substitute part validations, multi-year buys (MYBs), and part emulations. The organization that "owns" the circuit cards must keep track of these proposed mini-projects and submit them into the budget process at the next cycle. Often, when a program finds a solution that works (e.g., life-of-type buy, redesign, bridge buy, etc), they have a tendency to lock onto that solution and use it to address all DMSMS issues. However, there is usually no one best solution. Therefore, an important part of the programs' metrics is resolution type and cost to implement. This requires a method to track the various types of solutions used and their associated costs. This enables a program to measure success and track trends. For instance, it enables the compilation of internal benchmarks that are useful in many ways, including establishing appropriate performance goals for PBL providers.

Synthesizing individual solutions into a recommendation for an entire LRU or subsystem requires close examination of the facts. Intelligent obsolescence problem assessment and recommendation require a total system engineering approach. The DMSMS Operations element must include a means of condensing the myriad of individual recommendations into a succinct report for a given LRU that facilitates understanding, tracking, and action. Section 3.4 discusses various resolutions for each Acquisition phase.

For an organization located at several dispersed sites, a DMT Liaison at each site will help prevent unnecessary processing delays. Timeliness in processing PPRs, getting the crucial data, and following-up on budgeting actions are major concerns for the platform DMT. If the PPRs go to an organization with no active platform DMT member, the chance of process breakdown is quite high. Therefore, this consideration must be addressed in planning and contracting. It is important to keep the process moving as windows of opportunity for lower cost resolutions may be very short (i.e., last time buys).

3.2.2.3 Support. The DMSMS Management Program will require support activities to train, inform, improve, report, measure, and analyze the DMSMS program. Support tasks must be assigned to the various DMT members in the plan (and in the contract for the PIA, as applicable). Examples of support activities include:

- Executing DMSMS action items.
- Refreshing the prioritization list with new data at planned intervals.

- Preparing themes, agendas, arrangements, and minutes for your DMT meetings. This responsibility would be shared between the PM and the PIA.
- Participating in weekly DMT teleconferences, as required.
- Training DMT members to use the DMSMS data tools.
- Developing a descriptive presentation of the DMSMS Program.
- Preparing and delivering program management reviews for Senior Management.
- Generating and posting monthly metrics on PPR processing and DMT output.
- Performing analyses of cost and operational effectiveness of the program.
- Representing the DMSMS Program at Defense Industry forums.
- Collecting part consumption and failure data.
- Prepare Program Objective Memorandum (POM) justification for resolution projects.

3.2.3 Examples of Successful Programs

3.2.3.1 The B-2 Bomber DMSMS Management Program. The B-2 DMSMS Management Program has been identified in the DoD Deskbook as a Best Business Practice. The Program Executive Officer for USAF Fighters and Bombers described this program as a benchmark worthy accomplishment. The B-2 DMSMS Program is definitely proactive and effective. This assertion is factually substantiated in the *DMSMS Management Plan for the B-2 Weapons System (Proactive Risk Management)*, January 2005. The purpose of the document is to describe how the B-2 DMSMS Program complies with DoD requirements for DMSMS risk mitigation. This program is a model of teamwork to effectively support the platform.[8] The B-2 DMSMS Management Plan can be accessed on the DKSP web site along with other examples of DMSMS management plans.

3.2.3.2 The GPS DMSMS Management Program. The Global Positioning System (GPS) DMSMS Management Program is a well-established, proactive DMSMS Management Program to support the long-term requirements of many versions of the GPS. The program is unique in that it is multi-service oriented as it supports systems used in Air Force, Army, and Navy platforms. It is easy to see that teamwork is the key to success of the GPS IPT in successfully managing obsolescence issues. In 2002, the team won the Air Force Chief of Staff Team Excellence Award (CSTEA) for exceptional teamwork. Moreover, this team's DMSMS process was selected as an Air Force Best Practice. These are positive indicators that the program is on the right track.

3.2.4 Shared Data Warehouse

DLA HQ, in an effort to enhance and improve the sustainability of DoD weapons systems when DMSMS issues arise, initiated the development of the Shared Data Warehouse (SDW). The SDW promotes a single methodology for the processing of

DMSMS notices of discontinuance. It allows systematic searches conducted in an automated mode, automates workflow processes, and provides seamless connectivity to various disparate reference sources. It has a single point of entry that leverages existing information and data resources without replication or relocation.

The SDW is being utilized by DSCC's DMSMS office. A SDW server has been installed at GIDEP, and this center is poised to start full implementation with direct uploads to the SDW server at GIDEP allowing seamless connectivity between DSCC, GIDEP, and DOD customers (i.e. Air Force, Navy, and Marine Corps).

3.2.5 The DMSMS Knowledge Sharing Portal (DKSP)

The DKSP is a DoD portal that offers the PM a source for information to aid in obsolescence management. The DoD sponsor, Defense Standardization Program Office (DSPO), has facilitated and empowered a team to bring the DKSP to reality.

PMs will be able to access the DKSP and get help to proactively manage their DMSMS problems using its tools, services, and data. While the DKSP is still a work in progress, great strides have been made in setting up the website and populating it with relevant DMSMS information, links, training and other information. Portions of the site allow unrestricted access while other portions are password protected. The restricted sections of the site require you to be a GIDEP user (see how to register for GIDEP at www.gidep.org). The DKSP can be accessed by government and contractor personnel as authorized with the applicable accesses. Information on how to access the restricted portions is available at the site. Visit this website for more information: http://www.dmsms.org/

3.2.6 DMSMS Training Resources

The following is a list of available DMSMS training resources:

- Defense Acquisition University (DAU) LOG 102 Sustainment Management Fundamentals Course
- DAU LOG 204 Configuration Management course (scheduled for deployment in FY06)
- DAU LOG 235A and LOG 235B Performance Based Logistics Courses
- DAU CLL 201 "DMSMS Fundamentals" Continuous Learning Module
- DAU CLL 202 "DMSMS for Executives" Continuous Learning Module
- DAU CLL 203 "DMSMS Essentials" Continuous Learning Module (scheduled for deployment in FY06)
- DAU CLL 204 "DMSMS Case Studies" Continuous Learning Module (scheduled for deployment in FY06)
- DAU Logistics Community of Practice (LOG CoP) DMSMS and Obsolescence Resources
- DOD DMSMS Working Group-sponsored classroom versions of the DAU Continuous Learning Modules

Additional information on DAU training resources can be found at https://www.acc.dau.mil.

3.2.7 DMSMS-Related Web Links

Note: If hyperlinks do not connect, try a "copy and paste" of the URL into your web browser.

Additional DOD Resources (by no means all inclusive)

Air Force Materiel Command (AFMC) DMSMS Program AFMC DMSMS-related activities and links to DoD and industry Web sites.	http://www.ml.afrl.af.mil/dmsms/default.html
US Army Materiel Command Logistics Support Activity (LOGSA) LOGSA serves as the Army and DoD champion for the integrity and integration of logistics data in support of weapon systems maintenance, readiness, supply, transportation, equipment authorizations, asset and in-transit visibility. DMSMS Management Plan (DMP) generator (Also known as Plan Builder) assists in developing DMSMS program management plans.	https://www.logsa.army.mil/whatnew.htm
Defense Acquisition University (DAU) Logistics Community of Practice (LOG CoP) -- DMSMS, Obsolescence, and Continuous Modernization (CM) resources Systems Engineering (SE) CoP -- Open Systems, Commercial Off-The-Shelf (COTS), and Evolutionary Acquisition (EA) resources.	DMSMS & Obsolescence: https://acc.dau.mil/simplify/ev.php?ID=11656_201&ID2=DO_TOPIC CM: https://acc.dau.mil/simplify/ev.php?ID=61300_201&ID2=DO_TOPIC Open Systems: https://acc.dau.mil/simplify/ev_en.php?ID=56615_201&ID2=DO_TOPIC EA: https://acc.dau.mil/simplify/ev.php?OD=1487_201&ID2=DO_TOPIC COTS: https://acc.dau.mil/simplify/ev_en.php?ID=56619_201&ID2=DO_TOPIC
Defense Acquisition University (DAU) on-line Continuous learning Modules (CLM)	https://learn.dau.mil/html/clc/Clc.jsp

DAU CLL 201 “DMSMS Fundamentals” Continuous Learning Module DAU CLL 202 “DMSMS For Executives” Continuous Learning Module DAU CLL 203 “DMSMS Essentials” Continuous Learning Module (scheduled for deployment in FY06) DAU CLL 204 “DMSMS Case Studies” Continuous Learning Module (scheduled for deployment in FY06)	https://learn.dau.mil/html/clc/Clc.jsp?fTopic=All&fKeywords=dmsms
Defense Acquisition University (DAU) Courses DAU LOG 102 Sustainment Fundamentals DAU LOG 235A&B Performance Based Logistics DAU LOG 204 Configuration Management (scheduled for deployment in FY06)	http://www.dau.mil/registrar/enroll.aspx
DoD Acquisition, Technology, and Logistics (AT&L) Integrated Framework Chart (IFC) lifecycle activities and milestones	http://akss.dau.mil/ifc/
Defense Logistics Agency (DLA) Knowledge broker, providing comprehensive, best practice technological support to the DoD/DLA logistics business community.	http://www.dla.mil/
Defense Logistics Information Service (DLIS) National Stock Number information on CD-ROM, on-line, and web products. DLIS tools include: • DESEX (Defense Supply Expert) • DRMS (Defense Reutilization Marketing Service) • JTAV (Joint Total Asset Visibility) • DLA Status (Defense Logistics Agency Status) • EMALL (Electronic Mall) • DAMES (DAASC Automated Message Exchange) • Web REQ (Web REQuisition) • DSS (Distribution Standard System)	http://www.dlis.dla.mil/

• GTN (Global Transportation Network) • ITV (Radio Frequency In-Transit Visibility) • Web VLIPS (Web Visual Logistics Information Processing System)	
Defense Supply Center Columbus (DSCC) Information on DMSMS program at DSCC which manages the majority of electronic components for the DOD.	http://www.dscc.dla.mil/
DSCC Generalized Emulation of Microcircuits (GEM) Program Information on form, fit, and function replacement for non available microcircuits using current design and processing technologies.	http://www.dscc.dla.mil/programs/gem/
Defense MicroElectronics Activity (DMEA) DMEA provides technologically correct and economically viable solutions to microelectronic obsolescence.	http://www.dmea.osd.mil/
DMSMS Knowledge Sharing Portal (DKSP) The DoD-sponsored DMSMS DKSP exists to encourage communication, education and cooperation among interested and affected agencies within the DMSMS world, assisting everyone in achieving solutions to DMSMS challenges.	www.dmsms.org
Government-Industry Data Exchange Program (GIDEP) Cooperative activity between government and industry participants seeking to reduce or eliminate expenditures of resources by sharing technical information essential during research, design, development, production and operational phases of the life cycle of systems, facilities and equipment.	http://www.gidep.org/
NAVSEA Crane Division DMS Technology Center The DTC provides in-depth DMS management and	http://dtc-dms.crane.navy.mil/dtc.htm

solutions for all its customers. The DTC is the Navy's premier and only chartered source to aid in DMS program management.	
Navy Logistics Productivity (NLP) R&D Navy's official COTS site which provides general information, policy, guidance, and tools.	http://nlp.navsup.navy.mil/nlp_index.html
Shared Data Warehouse (SDW) Promotes a systematic, single methodology for processing notices of discontinuance and facilitates a central repository for DMS management within DoD, provides rapid, economical identification, dissemination, and processing of DMS affected part numbers and national stock numbers.	http://www.gidep.org/mod_perl/framepage.cgi?pg=/data/dmsms/initiatives/datawarehs.htm

3.3 Bill of Materials (BOM) Development

A BOM is a listing of parts and required quantities; electronic, electrical, mechanical, and materials, used to identify repair parts or parts needed to fabricate (produce) a system or assembly. An indentured BOM shows the relationship of components from component to board, to box, to system, generally in a top-down breakout format. A flat file BOM lists parts without indenturing relationships. Next to the DMT itself, the BOM is perhaps the most valuable asset in enabling the real work of proactive DMSMS management. Without it, all of the impact analysis, component analysis, prediction of discontinuance, tool selection and overall proactive DMSMS management would not be possible. The single most common missing component, for many reasons, of any DMSMS Program is the accurate, complete, indentured, current configuration BOM. One of the first things that the DMT will need to do is obtain it (probably for cost from the integrating OEM) or develop it from available data (most likely the Illustrated Parts Breakdown [IPB] technical orders), or negotiate for access if contractor-owned (such as under a PBL contract). Until the DMT has this critical set of information, the program will only be able to do detailed analysis on those assemblies where data is available to list the indenture from LRU, to board, to component. Along with the BOM, the DMT should also have access to the associated Design Data Packages (DDPs) and Engineering Change Proposals (ECPs).

The following describes the minimum information that DMSMS predictive tools/services need to meet DOD shared data objectives:

- Item name/description
- National Stock Number (NSN)

- Prime contractor/OEM part number including packaging and revision codes
- Associated original manufacturer name, part number, CAGE Code, and packaging and revision codes
- Commercial and Government Entity (CAGE) Code
- Unit quantity
- Firmware version (if applicable)

The preferred format for the BOM is in an editable electronic open standards-based format. DID # DI-SESS-81656 should be considered to identify, forecast, and manage obsolescence impacts and mitigations as part of the contract data requirements.

The DMT can make a decent start on proactive DMSMS management, using one of the predictive tools, if they can at least obtain or create a temporary BOM that reflects the active devices. With this limited BOM, the DMT can load a predictive tool, identify the status of components and perform some basic analysis. As the DMT gets better at managing DMSMS problems, they will realize that in any redesign or new system acquisition, they should process or acquire the BOM right along with the new boards or systems. It may be prudent to require the procurement of some type of BOM data on any new system acquisitions.

Many COTS OEMs will not release a BOM due to reasons like competition or proprietary claims, or per the PBL contract. In lieu of COTS product BOM, periodic surveys can be conducted of the COTS OEMs to provide a current status of the product and projected life. Data from these surveys needs to factor in the vendor's internal DMSMS program and reliability of data provided by the vendor. In PBL contracts, BOMs are not generally required as obsolescence management responsibility is delegated to the PBL provider. However, in these situations, the DoD must be protected in the event that the provider ends support of the weapon system and/or gets out of the business. This should be covered in contract exit clauses and criteria which require all technical data necessary to either compete the product support or establish organic capability. An excellent example is the V-22 AE1107 Engine Technical Data license. In this instance, if the contractor raises the price per engine hour over the established formula, they must turn over a complete technical data package to the Government. Additionally, the Auxiliary Power Unit/Total Logistics System (APU TLS) PBL contract has an exit clause that establishes an exit Integrated Product Team (IPT) and ensures that the Government receives all data necessary to re-establish full product support capability. The PBL contract should be structured to allow for access and visibility to the latest as-built/as-maintained configuration management data from the PBL provider.

In a non-PBL environment, the OEM should be asked to consider providing access to the BOM well in advance of announcing an end-of-production/end-of-support/end-of-

life date. This may come at a price. During acquisition and production, the OEM should be required to provide a list of obsolete, or soon to be obsolete, devices. Although this latter approach is reactive, it will at least provide the procuring authority the opportunity to verify that the parts are in fact obsolete or in danger of becoming obsolete.

3.4 Resolution Alternatives by Acquisition Lifecycle Phase

3.4.1 Alternatives Through the System Acquisition Life Cycle Phase

The phases of the DoD Acquisition life cycle are shown in Fig 3-5 below.[9]

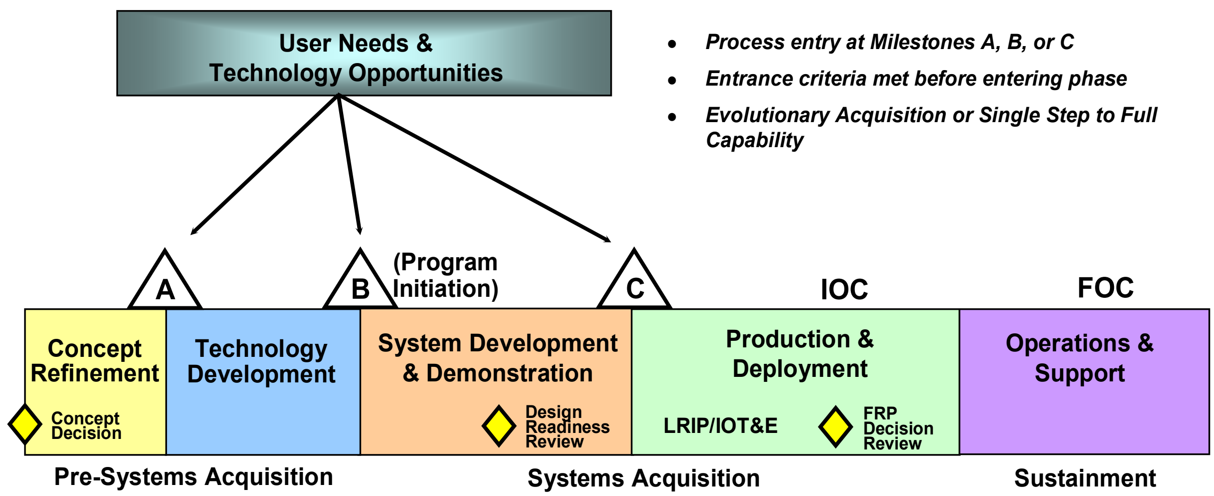


Figure 3-5. The DoD Acquisition Life Cycles [9]

The practical resolutions for a DMSMS problem are greatly dependent on where the item, or supported system, is in its life cycle. However, it is possible that a single item could support several systems that are at different points in their life cycle, resulting in a much more intense analysis of alternatives and an offset of costs and benefits to any single solution. Table 3-5 is a paraphrased (converted from narrative to table format) compilation of resolutions. It was selected based on its broad representation of the resolution types segmented by most common applicability to acquisition phases. Not all will be applicable to every program or platform, but may be helpful in initiating the thinking process. The table depicts the resolutions as they pertain to each of the acquisition phases: Pre-Systems Acquisition, System Acquisition, and Sustainment.

Table 3-5. Resolution Alternatives by Life Cycle Phase [10]

Resolution	Pre-Systems Acquisition	Systems Acquisition	Sustainment
Performance Based Requirements	X	X	
Open Systems Architecture	X	X	
Modification or Redesign	X	X	X
Redefined Requirement	X	X	X
Commercial Item Substitution	X		
Modernization Through Spares	X	X	X
Design Techniques	X		
Breakout		X	
Bridge Buy		X	X
Life-of-Type (LOT) Buy		X	X
Contractor Requirement or Availability Guarantee		X	X
Existing Source (Stock)		X	X
Alternate Source		X	X
Existing Substitute		X	X
After-Market Vendor			X
Emulation			X
Government/Organic Fabrication Facility		X	X
Reclamation		X	X
Technology Refresh		X	X
Use Early Warning Databases			X
VHDL			X
Early-Life-Cycle Parts Procurement		X	X
Performance Based Logistics Support Strategy		X	X
Continuous Modernization		X	X
System Upgrade and Service Life Extension Programs (SLEP)			X
Contractor Maintained Inventory		X	X
Defense Priorities and Allocations System (DPAS)			X
Joint Material Priorities and Allocation Board (JMPAB)		X	X
DLA War Stopper List		X	X

3.4.2 Resolution Definitions

The resolutions listed above are defined below.

- **Performance Based Requirements.** Performance based requirements are parameters that best represent the warfighters needs. They are to be "performance" or "results" focused rather than "piece part" or "process/transaction" focused. Refer to SD-15, Performance Specification Guide, for a more complete reference to writing Performance Based Requirements,

- **Open Systems Architecture (OSA)**. OSA is a business and engineering strategy that seeks to develop systems architectures that employ the use of open systems interface standards to the maximum extent practical. An open systems interface standard is a publicly available document defining specifications for interfaces, services, protocols, or data formats established by consensus and widely used in the marketplace. The OSA objective is to improve weapon system affordability and sustainment by reducing impacts associated with anomalies such as out-of-production parts, technology obsolescence, and single source suppliers. DOD Acquisition Executives should use "open systems" specifications and standards for acquisition of all weapon systems to the greatest extent practical.

- **Modification or Redesign**. Modify or redesign the end item to drop the part in question or replace it with another.

- **Redefined Military Requirement**. Redefined military requirements redefine the military specification (MIL-SPEC) requirement through appropriate engineering support activities, and consider buying from a commercial source.

- **Commercial Item or Non Developmental Item Substitution**. Non developmental item substitution replaces the DMSMS component, SRU, or LRU with a commercially available item, if possible.

- **Modernization Through Spares**. Modernization through spares uses acquisition strategy and techniques to replace the obsolete part(s) by attrition. See additional information on Continuous Modernization in section 3.4.3.

- **Design Techniques.** Design techniques are implemented to mitigate/minimize the effects of, or the onset of, technology obsolescence. Consider: a) including Critical Design Review (CDR) criteria specifying manufacturing life before discontinuance or, b) requiring a waiver if criteria are not met, e.g. 5 or 10 year waivers.

- **Breakout**. Breakout separates the DMSMS part from the component or subsystem to facilitate redesign or replacement.

- **Bridge Buy**. A Bridge buy is made for a sufficient number of parts to allow time to develop another solution.

- **Life-of-Type Buy**. A life-of-type buy procures a sufficient quantity of the DMSMS part to ensure full production plus repair for the expected life cycle of the system. Costs for packaging, storage, and transportation must be considered. These costs may be reduced by identifying alternate sources of manufacture/supply or support.

- **Contractor Requirement**, also known as **Availability Guarantees**. Contractor requirement or availability guarantees require a contractor, through contractual agreements, to maintain an inventory of DMSMS items for future production use. Under some circumstances, a supplier may guarantee long-term availability of a part or family of parts. Uncertainties inherent in such an arrangement, very high cost, and the feasibility of the existence of such a contract are factors that need to be addressed. Contractual approaches may lead to the movement of efforts at solving obsolescence problems from the government to industry, or it may lead to new design approaches or system operation regimens.

- **Existing Source (Stock)**. Existing source utilizes current inventories.

- **Alternate Source**. Alternate sources may include a smaller company that might undertake production that is no longer profitable for a larger company. A proactive DMSMS Management Program may identify sources of supply that may qualify as a small or disadvantaged business. Consider split allocation of the procurement to ensure that at least two suppliers maintain production capability. The buyer must ensure that the alternate source is providing certified parts. One way is through traceability back to the original manufacturer showing authorization from the OEM. The ultimate check is by ensuring part qualification and certification through the weapon system engineering support authority to meet requirements of form, fit and function.

- **Existing Substitute**. Existing substitute items may perform fully (in terms of form, fit, and function) in place of the DMSMS item.

- **Aftermarket Manufacturer (Reverse Engineer)**. Aftermarket Manufacturing seeks an aftermarket producer to obtain and maintain the design, equipment, and process rights to manufacture the component after the original manufacturer either ceased or ceases production. Ensure the manufacturer is qualified, by appropriate service authority, to produce the part.

- **Emulation**. Emulation uses current design and manufacturing processes to produce a substitute item (form, fit, and function) for the DMSMS item. See section 3.3.4 for additional information on emulation programs.

- **Government/Organic Fabrication Facility**. Government/organic fabrication facilities can be considered when an obsolete item could qualify as a special fabrication project. Can also serve as an Aftermarket Manufacturer.

- **Reclamation**. Reclamation takes DMSMS parts from marginal or out-of-service equipment or, when economical, from equipment that is in a long supply or potential excess position. This assumes the end item has not been transferred to Defense Reutilization and Marketing Service (DRMS) for disposal. Investigate the potential for reclaiming items from DRMS. However, parts from DRMS will not have a handling history. Be aware that reclamation has possible drawbacks such as electrostatic discharge damage, handling damage, and heat damage from unsoldering.

- **Technology Refresh**. Technology refresh replaces the electronics in a system over a specific period of time. The period of Technical Refresh events depends on the product type and the system support strategy employed. It will also utilize various DMSMS resolution options. A drawback to this approach is that it is usually quite expensive but this expense may be offset by the improved operational capability or greater reliability, or both, afforded by the early incorporation of later, more sophisticated technology. It may also eliminate potential incompatibilities among updates in technology. Note: this can also be considered Continuous Modernization and/or Service Life Extension Program (SLEP) resolution, based on the systems acquisition strategy and acquisition spiral approach.

- **Use Early-Warning Databases**. Early warning databases implements the reactive approach to resolving obsolescence cases by maintaining detailed databases. The database should contain information about every part in the system. These databases should become proactive tools if projections of the obsolescence of all parts are incorporated and a systems health analysis is performed. With a database encompassing the system's entire indentured parts list and a projection of parts obsolescence, a system manager, or engineer, could decide the optimum level (part, board, subsystem or system) of replacement. He/she then could schedule for replacements required to maintain the functionality of the system. Also, maintaining the data electronically allows quick research of obsolescence notices, part reliability, availability, maintainability, and sustainability. This type of analysis supports the manager's programming for the funds to accomplish the needed replacements. Another reason to have the complete set of system parts in an electronic database is that you can utilize electronic comparison routines. This allows for the comparison of parts you have versus the obsolescence notices that originate from multiple sources (e.g., GIDEP and DSCC).

- **Design for Obsolescence:** The Very High Speed Integrated Circuit (VHSIC) Hardware Descriptive Language (VHDL) has become a standard design tool throughout much of the electronics industry. Components, boards or systems

designed using VHDL are described in such a way that replacement with different components is very straightforward. In particular, the replacement of a part or any assembly of parts with newer or different technology does not require redesign. In order for VHDL to be used effectively, it has to be added to the contract. The contractual requirement should be to deliver to the government, with unlimited rights, a behavioral VHDL model with test bench, for digital components.

- **Early-Life-Cycle Parts Procurement**. Early-life-cycle parts procurement involves judicious part selection for a replacement of an obsolescent part or as a component in a new design may prevent or delay obsolescence. Selecting a part that is relatively new in its life cycle is a hedge against early obsolescence. A further guide in predicting the potential lifetime of a part can be found in assessing the new device types and technologies being adopted by the manufacturers. It is sometimes possible, especially if large production expenditures are involved, to predict the families of parts that will be replaced by a new product line.[11]

- **Performance Based Logistics Support Strategy**. A PBL support strategy, particularly at the system and platform level, is particularly effective in placing responsibility for DMSMS and obsolescence planning, as well as continuous modernization and technology insertion, upon the PSI who in many instances is also the OEM. It is critical that the performance based arrangement, especially in the form of a public private partnership contract [between private industry and government/organic facility(s)], address proactive DMSMS risk management.

- **Continuous Modernization**. CM is a process by which state-of-the-art technologies are inserted continuously into weapons systems to increase reliability, lower sustainment costs, and increase the war fighting capability of a system to meet the ever evolving customer requirements throughout an indefinite service life. Planned continuous modernization is an important component of any PBL support strategy. Further information is contained in paragraph 3.4.3. Note: this can also be considered a SLEP based on the systems acquisition strategy and acquisition spiral approach.

- **System Upgrade and Service Life Extension Programs (SLEP).** SLEP initiatives and upgrades are a means to implement product improvement. However, they are expensive and often require a moratorium on modification of large portions of system fleets during the upgrade process to facilitate configuration management. Upgrade programs often fall prey to budget constraints, where rising operations and support (O&S) costs detract from modernization funding. The modification prioritization process necessarily gives preference to required safety modifications over performance or modernization upgrades. Because the cost of installing modifications into systems for capability, reliability, maintainability, or affordability purposes is high, individual upgrades are often deferred until they can be collected into affordable block upgrade

packages that can be implemented during a single product modification cycle. Although this collection process delivers modernization, it is often unresponsive to the warfighter's evolving needs. The processes also establish a technological point solution that may be obsolete even before the upgraded system is delivered. Note: this can be considered Continuous Modernization, based on the systems acquisition strategy and acquisition spiral approach.

- **Contractor-Maintained Inventory**. Contractor maintained inventory requires the contractor to implement contractual agreements to maintain an inventory of DMSMS items for future DoD needs. Similar to the LOT Buy alternative except that the contractor is maintaining the inventory, not the government.

- **Defense Priorities and Allocations System (DPAS)[12]**. DPAS assures the timely availability of industrial resources to meet current national defense and emergency preparedness. Provides an operating system to support rapid industrial response in a national emergency.

- **Joint Materiel Priorities and Allocation Board (JMPAB)[13]**. The JMPAB is responsible for the following:

    - Modify and recommend priorities for allocations of materiel assets for the fulfillment of logistic requirements of the theater (both US and allied forces).
    - Review, act on, or forward requests for modifications in force and activity designators to the Joint Staff.
    - Review, act on, or forward request to establish or change the priorities in the master urgency list to the Joint Staff.
    - Prepare recommendations to the Joint Staff on modifications to priorities and allocations of resources assigned to other commanders of a combatant command (CINCs).

- **DLA War Stopper List.** The DLA War Stopper is a HQ DLA program that addresses the resolution of Warfighter Critical Shortage List items, including related supply chain issues.

Appendix C provides an "Assessment of DMSMS Resolution Alternatives" matrix that identifies the typical impacts to cost, schedule, and performance from the set of resolution alternatives considered.[6] It is included as an appendix for additional information on this subject.

3.4.3 Continuous Modernization (CM)

CM is a process by which state-of-the-art technologies are inserted continuously into systems to increase reliability, lower sustainment costs, increase the capability of a system, and meet evolving customer requirements throughout an indefinite service life.

The objective of CM is to keep systems within the range of supported technology with widely available support resources at an optimal support cost. This would include wide availability of spare parts, repair sources, current and available technical data, and optimal support costs. CM is aided by use of: COTS/Non-Developmental Item (NDI) preferences, ECPs and Value ECPs (VECPs), Open System Architectures, and PBL. These strategies are described below:

3.4.3.1 COTS/NDI preferences:

- COTS/NDI have a broader commercial base than build-to-order software and hardware products.
- COTS/NDI cost less to acquire and support than military specification equipment.
- Because COTS/NDI are commercial, industry often funds R&D effort, rather than the Government.
- Commercial industry has much shorter time-to-market cycles than traditional military acquisitions.
- Shorter cycle times result in continuous and rapid improvements in technological capabilities—unlike build-to-order designs.
- The Government Electronics and Information Technology Association (GEIA), in collaboration with the Defense Standardization Program Office (DSPO), has developed minimum requirements for integrated circuits and semiconductors and designated them as Aerospace Qualified Electronic Component (AQEC). The AQEC group is a collection of over 15 semiconductor manufacturers and avionics developers whose primary purpose is to enhance COTS usage throughout DOD The intention is to:

    - Provide AQEC users access to information, from the AQEC Group, necessary to use COTS products.
    - Enable AQEC users to better assess that these parts are capable of operating reliably in their applications..
    - Minimize deviations from the AQEC manufacturer's COTS products.
    - Have minimal impact on the AQEC manufacturers' standard operating or business procedures.
    - Promote communications between the AQEC manufacturers and users.

  An AQEC document establishes guidelines for producing "modified COTS" parts, somewhere between MIL-SPEC and pure commercial. AQEC suppliers are required to provide products for five years or more, or provide information on how to obtain the part if the life cycle is shorter. AQEC also provides DOD better knowledge of parts being used across all weapon systems as well as efficiencies of volume buying.

3.4.3.2 ECPs/VECPs

The ECP process is often a cost obsolescence mitigation solution and can be slow. Responsibility for identifying and mitigating obsolescence risk remains with the Government. VECPs on the other hand can:

- Incentivize reduced cost, increased quality, and improved performance.
- Employ a simple, flexible, and structured set of tools, techniques, and procedures to promote innovation.
- Create incentives to achieve best value solutions as part of a successful business relationship.
- Encourage industry to reduce total ownership cost, although it does not specifically address obsolescence risk.

However, the DMT should be watchful for artificial savings identified in the VECP that might not exist, had there been a proactive DMSMS management program in place or if DMSMS responsibility was contracted. When reviewing and approving related ECPs or VECPs, the cost impacts and potential savings over the expected life cycle should be carefully understood by the DMT.

3.4.3.3 Open Systems Architectures:

- Enable insertion of available, stable, supportable COTS items, adding new technology with little or no government R&D cost.
- In a new system, offer the best opportunity to execute an effective continuous modernization strategy.
- Facilitate a long-term sustainable system not held hostage to obsolescence and diminishing manufacturing sources.
- Utilize commonly used interfaces between components - usually conforming to an accepted commercial standard.
- Ensure easy replacement of failed components as long as the replacement item conforms to the same standard interface, passes testing, and can be technically “tuned” for the specific application.
- Have three primary characteristics: industry standards and specifications of key interfaces, modular design and functional partitioning of hardware and software, and configuration, interface, and conformance management.
- The bottom line: the greater the “openness” of system interfaces, the easier it is to accomplish CM.

3.4.3.4 Performance Based Logistics.

- PBL facilitates Continuous Modernization because the support integrator and providers bear the risk and cost of obsolescence. PBL is a new way of doing business. Unlike traditional approaches to modernizing current systems, PBL holistically manages sustainability and availability of systems. Additional information on PBL can be found in Section 2.0.

3.4.4 DLA Microcircuit Emulation Programs

Using an innovative approach of combining Government-sponsored technology development with existing private industry production capacity, DSCC, DLA HQ and the Sarnoff Corporation of Princeton, NJ, have developed two highly effective microcircuit programs in order to ensure the availability of form, fit, function replacement spare parts. These programs break the obsolescence cycle by guaranteeing availability for as long as the need exists. The Generalized Emulation of Microcircuits (GEM) Program addresses the problem in the area of earlier digital logic (e.g., 54H, 54L, 54XX, 54LS, 10K ECL), small SRAM and ROM memories and some interface functions. Since beginning low rate initial production in 1993, GEM has supplied over 70,000 parts supporting over 300 weapon systems and has achieved cost avoidance that has been estimated to be as high as $400M. The Advanced Microcircuit Emulation (AME) Program is addressing technologies which are beyond the capability of GEM. In addition to advanced digital logic families (54F, 54AS, 54FCT, 10H ECL), AME has ASIC capabilities ranging from 10,000 to 200,000 gates and advanced reverse engineering through e-beam technology. AME can support all but the most advanced commercially available technology and has a development roadmap to continue to develop greater capabilities. AME's capabilities are such that systems under current development can be fielded using its technology, thus avoiding obsolescence concerns altogether. At the very least, AME could be an integral part of a weapon system program's long-term support strategy for advanced microcircuit technologies.

4 ANALYZING RESULTS (MEASURES)

4.1 Introduction

The following section will provide examples of measuring DMSMS Management Program cost, schedule, and performance (or supportability). These examples are, by no means, provided as being prescriptive. They are presented only as a reference for building organizational, or program-specific, measuring tools.

4.2 OSD Criteria for DMSMS Program Rating

4.2.1 OSD Color-Coded Rating Scheme

The following color-coded rating scheme is being utilized by PMs as a self assessment for measuring the effectiveness, or health, of an ACAT I DMSMS Program. In other words, how proactive is a particular DMSMS Program? (Note that this measurement is distinguishable from how the DMSMS Program impacts the weapon system. That aspect is part of the operational readiness, or Performance, assessment in Section 4.5.)

Green: Requires a favorable or positive response to all of the following factors:

1. Is there a written DMSMS Plan? (Coordinated with Services "DMSMS" WG/Office)
2. Is DMSMS Support to the PM in a "Health Managed Organization (HMO)" format? (i.e., PBL, contractor logistics support [CLS], and/or Government Assistance contractual arrangement: in other words, a neutral third party being proactive and looking out for the best interests of the program)
3. Does your program have a BOM in a digital database for your entire program down to the microcircuit level? TDPs, ECPs, and Technical Manuals are available and usable by the DMSMS Team)
4. Are Information Technology (IT) DMSMS Tool(s) in use, connected to Services DMSMS IT resources and GIDEP?
5. Are DMSMS Cases, Resolutions, and Cost Avoidance reported through Services to GIDEP?
6. Are DOD and Services DMSMS Metrics tied to PM Life Cycle Program Management?

Yellow: Considering the six factors above: Deficient in at least one, but not all, factors for Green.

Red: Considering the six factors above: Reactive (no factors are completely addressed).

White: Not rated

With a PBL contract, strategy will vary in terms of desired performance outcomes and the metrics that specify those outcomes. In general, OSD has specified the five "top level" PBL metrics that every PBL strategy should try to achieve.

a. Operational Availability
b. Mission Reliability
c. Cost Per Unit of Usage
d. Logistics Footprint
e. Logistics Response Time

However, it may not be possible to specify those exact metrics, dependent upon the scope of authority for management of the support functions that produce those outcomes. Therefore, subordinate metrics that contribute to those outcomes, and as they relate to the effectiveness of a particular DMSMS Program, primarily in the areas of Maintenance (e.g. Mean Time To Repair, Repair Turnaround Time, Depot Delivery Days, and Supply (Not Mission Capable Supply, Ready For Issue) may need to be developed. More on these particular metrics is discussed at the following DAU website: https://acc.dau.mil/simplify/ev.php?ID=88342_201&ID2=DO_TOPIC .

4.2.2 OSD Tracking and Accounting for DMSMS Programs

Each OSD agency/office and Service component may elect to establish additional metrics for DMSMS Program tracking and accountability. Components of analysis can include:

- Items Received for Review
  - Alerts
  - Cases
  - End Items
- Number of Items Resolved to Defined Resolutions in paragraph 3.4.2 above.
- Shared Data Warehouse (SDW) Solutions
- DMSMS Dollar Value of Savings (see Section 4.3.2, Cost Avoidance)

4.3 Cost

4.3.1 Resolution Cost Trade-Off Studies

Once a PM completes the resolution selection process, a worksheet to estimate the implementation cost based on the practices selected needs to be completed. As an example, a blank worksheet for the Alternative, or Substitute, Source resolution type is shown in Figure 4-1.

ROM Cost Estimate

Alternative Source

Requirements ______ x Unit Cost ________ = __________

Nonrecurring Engineering = __________

Prototype Development = __________

Tech Data Development / Compilation = __________

Qualification = __________

Part Testing (Form, Fit & Function) = __________

System Testing = __________

Documentation Revision = __________

Warehousing & Disbursement = __________

DMSMS Analysis Labor:

Engineer Manhours ______ x Rate ________ = __________

Analyst Manhours ______ x Rate ________ = __________

Other Manhours ______ x Rate ________ = __________

Solution Total = __________

See Appendix A (2nd page) for terms clarification.

Figure 4-1. Alternate Source Resolution Cost Estimate Worksheet [6]

The completion of the worksheet is the first of two basic steps in determining a business case that validates the implementation of a particular resolution to mitigate the impact of obsolescence. The second step is to determine the cost of resolving obsolescence problems if a program is not or has not been implemented. This requires the estimation of TOC when no mitigation techniques have been implemented and a program has to react to supportability problems caused by obsolescence. This goes hand-in-hand with the unfunded liability issue discussed in Section 4.3.4. The following paragraphs describe various cost metrics that can be useful in determining that TOC cost.[6]

4.3.2 Cost Avoidance

4.3.2.1. Measuring DMSMS Solution Cost Avoidance. Recall that the supporting advocacy of a proactive DMSMS Management Program is that "finding solutions early will save money." Any claimed cost avoidance, or savings, cannot be realized by merely identifying a resolution. The resolution must actually be implemented for true avoidance or savings to result. Data has been published on the expected average costs for each of eight DMSMS solution types, including non-recurring engineering (NRE) when appropriate. Cost data was collected on only these eight solution types (Note: the resolutions discussed in Section 3.4.2 are a broader compilation of resolutions from across DoD and industry.). The average NRE cost values for the various resolution types, computed for 2004, 2005, and 2006, are shown in Tables 4-1, 4-2, and 4-3, respectively. For 2007 and beyond, DoD escalation factors should be used. It is emphasized that these values do not include system level qualification testing, software

testing, certification testing for safety of flight, or flight test costs. PMs should add these costs into the analysis based on the unique aspects of their specific systems. It is also noted that any solutions specific to the program office, such as a LOT buy, should be incorporated into the analysis. This means that programs should be keeping tack of actual resolution cost and should only use these values as a default.

Table 4-1. NRE Cost Metrics (2004) [15]

Resolution	Average
Existing Stock	$ 0
Reclamation	2,000
Alternate	7,000
Substitute	20,000
Aftermarket	52,000
Emulation	75,000
Redesign—Minor	122,000
Redesign—Major	450,000

Table 4-2. NRE Cost Metrics (2005) [15]

Resolution	Average
Existing Stock	$ 0
Reclamation	2,000
Alternate	7,000
Substitute	20,000
Aftermarket	53,000
Emulation	76,000
Redesign—Minor	124,000
Redesign—Major	460,000

Table 4-3. NRE Cost Metrics (2006) [15]

Resolution	Average
Existing Stock	$ 0
Reclamation	2,000
Alternate	7,000
Substitute	21,000
Aftermarket	54,000
Emulation	78,000
Redesign—Minor	127,000
Redesign—Major	469,000

These average costs are used in cost avoidance methodology, which (simply stated) is that for whatever solution your DMT recommends, one can consider an associated cost savings equal to the difference between the average costs of your solution and the next most feasible, as shown in Table 4-4 for 2004.

This cost avoidance methodology ranks each resolution from lowest cost to highest cost. Cost avoidance is determined by subtracting the average cost of a resolution derived proactively from the next most feasible average cost resolution (assumed to result from taking no action or a reactive DMSMS program). For 2004, the resultant mathematical calculation (subtracting the average cost of a resolution from that of the next most feasible average resolution cost) is depicted in Table 4-4.

Table 4-4. Cost Avoidance Values (2004) [14]

		Cost Avoidance (Next Costlier Feasible Solution)						
Solution	Solution Cost	Reclamation	Alternate	Substitute	Aftermarket	Emulation	Minor Redesign	Major Redesign
Existing Stock		$ 2,000	$ 7,000	$ 20,000	$ 52,000	$ 75,000	$ 122,000	$ 450,000
Reclamation	$ 2,000		$ 5,000	$ 18,000	$ 50,000	$ 73,000	$ 120,000	$ 448,000
Alternate	$ 7,000			$ 13,000	$ 45,000	$ 68,000	$ 115,000	$ 443,000
Substitute	$ 20,000				$ 32,000	$ 55,000	$ 102,000	$ 430,000
Aftermarket	$ 52,000					$ 23,000	$ 70,000	$ 398,000
Emulation	$ 75,000						$ 47,000	$ 375,000
Minor Redesign	$122,000							$ 328,000
Major Redesign	$450,000							

4.3.2.2. Example Calculation. An example can be shown using hypothetical resolution data from a weapons system we will call Platform X. We start with the number of times a resolution type was used in 2004 for a total of 181 obsolete parts. Using the average cost avoidance values from Table 4-4 and the Platform X resolution data, we determined the data summarized in Table 4-5.

Table 4-5. Cost Avoidance Estimate for Platform X (2004) [15]

Resolution	Probability of Occurrence (%)	Number of Occurrences	Average Delta	Cost Avoidance
Existing Stock	4.5	8	$ 2,000	16,000
Reclamation	0.0	0	5,000	0
Alternate	68.0	123	13,000	1,599,000
Substitute	19.0	35	32,000	1,120,000
Aftermarket	5.0	9	23,000	207,000
Emulation	3.0	5	47,000	235,000
Redesign—Minor	0.5	1	328,000	328,000
Redesign—Major	0.0	0	0	0
Total	100.0	181		3,505,000

To determine estimated cost avoidance resulting from a DMSMS Program for Platform X in 2004, we subtracted the cost of the DMSMS Program from the total cost avoidance of

$3,505,000. If the DMSMS Program cost was $325,000 for that year, the resultant estimated benefit for this example would be $3,180,000 for 2004.

4.3.2.3 Other Considerations for Cost Avoidance Calculations There are two situations in which adjustments to the cost avoidance calculation would be required:

- In some instances, **the next-higher-cost resolution may not be technically feasible**; for example, emulation may not be a viable alternative for a complex Application Specific Integrated Circuit (ASIC).

- A redesign may resolve DMSMS problems for more than one component at once. Cases have been documented where as many as five obsolete part problems were solved with one board or SRU redesign.[15]

As the DMSMS Program operations generate a growing list of solutions, it will be possible to associate a cost with each solution and compute the total cost avoidance of the current set of solutions. All the data necessary would be captured in the DMT database. When the program collects actual data (which may differ from the average DMEA calculated values in both resolution type and cost category), the DMT can keep a running track of cost avoidance as shown in Table 4-6: [8]

Table 4-6. Sample Solution Cost Avoidance Table for a Program [8]

Solution Type	Solution Status	PPR Count	Cost Avoidance Estimate
Emulation	Unfunded	11	
Obtain Firmware	Firmware Solution In Work	2	$60,000
	Unfunded	7	
Redesign Next Higher Assembly (NHA)	Unfunded	10	
Redesign Part	Engineering Solution Complete	5	$2,700,000
	Engineering Solution In Work	2	$1,100,000
	Unfunded	1	
Substitute	Engineering Solution Complete	1	$55,000
	Engineering Solution In Work	2	$94,000
	Unfunded	120	
Multi-Year Buy (MYB)	MYB Complete (with PPRs)	54	$1,800,000
	MYB Complete (no associated PPR)	500	$17,000,000
	MYB On Order	8	
	MYB Partially Received	10	$340,000
	MYB Protected at DSCC	6	$200,000
	Other	1	
	Unfunded	298	$0
No Support Impact	Approved Alternate Available	71	$200,000
	Part No Longer Used	17	
	Part Still Available	239	$720,000
	Sufficient Qty On-hand	206	$620,000
Reclamation	Reclaimed Parts On-hand	1	$0
	Reclamation In Work	1	$0
	Unfunded	2	
Transfer Assets	Transfer Complete	9	$27,000
	Transfer Pending	17	
			$24,916,000

4.3.3 Business Case Analysis (BCA)

The Services often use the BCA tool to make selections among alternative courses of action in implementing a DMSMS program. The BCA quantifies the economic value in terms of measures such as Return on Investment (ROI) and Break Even Point (BEP). Two analysts could look at the same data and generate different outcomes if they use different assumptions or modeling methodologies. Therefore the BCA assumptions used and methodology must be succinctly and fully disclosed.

4.3.3.1. Case Alternatives in the BCA. BCA methodology must generate a cost stream for each alternative under consideration– for DMSMS management, the alternatives are:

1) The Reactive Approach

2) The Proactive Program (what we've been describing in this guidebook)

There are only a few DMSMS Management Programs that have a DMSMS BCA that is updated annually to capture new input data (e.g., the latest LRU failure rates and the latest obsolescence trends) and DMSMS Management Program outcomes (e.g., new solutions).

4.3.3.1.1. Reactive Approach Case. In a reactive mode, the assigned Equipment Specialist, or Service equivalent, only processes and reacts to DSCC or GIDEP Discontinuation Notices (that is the extent of the DMSMS Program). DMSMS problems go unnoticed until a repair part such as an integrated circuit is needed. If that part is obsolete and unavailable, the SRU would quickly receive a focused attention from the responsible IPT. The cost and complexity of the resultant corrective action project would then depend on the "newly discovered" severity of obsolescence in the SRU. To model this scenario across an entire LRU or weapon system, and generate a cost stream for it, one must estimate and mathematically relate three entities:

- The number of SRU problems each year caused by obsolete unavailable parts
- The distribution of degree of obsolescence present in those SRUs
- The resolution costs for those SRUs associated with the varying degrees of obsolescence as described in paragraph 4.3.2.

These entities are then used to estimate a Reactive Approach cost, by year, for the platform.

4.3.3.1.2. For the Proactive Approach Case. Here the DMT identifies the obsolete parts in the platform configuration and preemptively resolves them (so that problems would be discovered and corrected early – before they impact the system support posture and operational availability). To model this scenario, you must relate mathematically three (different from 4.3.3.1.1 above) entities:

- The historical mix of resolution types (e.g., substitute part, emulation)
- The number of obsolescence problems estimated to be solved each year
- The resolution cost data for each type of resolution (as in the previous case)

Again, these entities are then used to estimate a proactive DMSMS management cost, by year, for the platform.

4.3.3.2. BCA Output. A principal output of the BCA is the Break Even Point (BEP), which shows the payback period of an alternative. It is found from a plot of the cumulative yearly benefit less the cumulative yearly operations cost, computed over the years of interest. The benefit for each year is the difference between the Reactive and Proactive Approach costs (see Sections 4.3.2.1 and 4.3.2.2 for an example). The BEP, the point where the plot crosses the X-axis, as shown in Figure 4-2, signifies that the cumulative investment in the Proactive Approach equals the cumulative benefit derived from that investment. At this point, the extra costs of the proactive program are offset and savings begin to accrue.

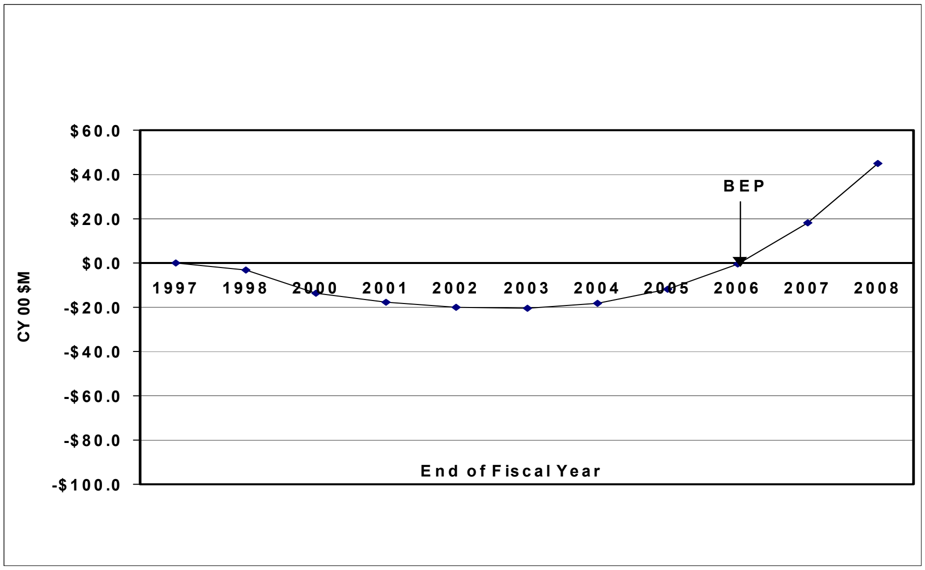


Figure 4-2. Sample Break Even Point Plot [8]

In addition to the BEP plot, a typical BCA would include a table of econometric values as seen in Table 4-7:

Table 4-7. Economic Analysis Summary (10 Year Study) [7]

Item	Reactive ($M)	Proactive ($M)	Notes
DMSMS Program Costs	N/A	$30M	
DMSMS Solution Costs	$180M	$65M	
Total	$180M	$95M	
Benefit		$115M	=$180M-$65M
Break Even Point		End of 2006	From a plot
Benefit to Cost Ratio		3.8	=$115M/30M
Return on Investment		2.8	=($115M-$30M)/30M
Net Value		$85M	= $180M-$95M

Table 4-7 shows a benefit of $115M (the difference between the cumulative solution cost for the reactive and proactive cases over the 10 year period). The investment cost of having a proactive program was $30M over that same period. Thus, the Benefit to Cost Ratio (BCR) is $115M/$30M = 3.8 and the Return on Investment (ROI) is ($115M-$30M)/$30M = 2.8. The BEP is found by plotting the quantity (Cumulative Benefit – Cumulative Cost) versus years. [7]

In sum, a proactive approach to DMSMS yields the best return for the warfighter. A reactive approach may place the warfighter and his mission in jeopardy, because he may not be able to use his weapon, or equipment, until a suitable replacement part or system is found. Whereas, a proactive approach has already incorporated the contingency of obsolescence and the impact on the warfighter and his mission is minimized.

4.3.4 Funding Impact

After a part obsolescence resolution is decided, the next step is to ensure funding is in place to implement the required resolution action. If funding is not available to implement the resolution, the PM must be willing to petition the Program Element Monitor (PEM), or other higher acquisition authorities, for the necessary funding. The PM and PEM must work together to input DMSMS requirements into the Five-Year Defense Plan (FYDP), taking into consideration the program phase, as well as the "color" (funding cite category) and year of money required. If the funding aspect is not pursued, then an "unfunded liability" exists that exacerbates the obsolescence problem in the future. In order to influence the budgeting process, a program must have data available that demonstrates the costs of a DMSMS plan and the potential cost avoided. To do this, a program must establish metrics that document recommended and approved solutions and monitor implementation. Tracking these metrics will demonstrate the true costs and benefits of DMSMS and enhance the funding process.

The following notional rating scheme is presented as an example to PMs to encourage a long-range view of funding requirements and how the time needed to acquire the funding can impact program status. The rating scheme considers DOD POM cycle time, resolution administrative lead time (ALT) and production lead time (PLT) (if needed). Note that these times, being program-specific and based on historical support, may vary from the sample below.

Red – obsolescence resolution < 3 years away (inside the 2 year POM cycle plus the 6-12 month ALT plus the 8-18 month PLT)
Yellow – obsolescence resolution ≤ 5 years but > 3 years away (outside the 2 year POM cycle plus the 6-12 month ALT plus the 8-18 month PLT)
Green – adequate spares based on Mean Time Between Failures (MTBF) support for ≥ 5 years

4.4 Schedule

4.4.1 Timeline

The same information presented above can be depicted differently to show a timeline, or schedule, status.

Timeline Determination = resolution timeline (includes ALT + PLT + funding timeline)

The timeline increases as the complexity of the resolution increases as shown in Figure 4-3.

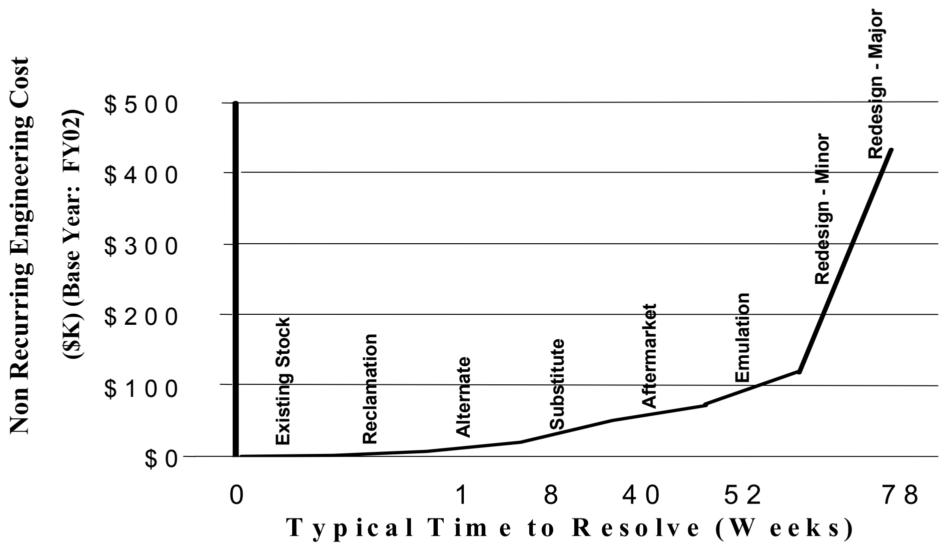


Figure 4-3. Time to Resolve and NRE Cost by Resolution Type

4.5 Performance

4.5.1 Operations Impact Analysis (OIA)

4.5.1.1. Role of the OIA. Some platforms have had a critical need for a companion analysis to the BCA to predict the effects of obsolescence on operational readiness. That need is addressed in the Operations Impact Analysis. Whereas the BCA predicts the cost effectiveness of your DMSMS Management Program, the OIA answers the question, "What happens to the inventory of LRU (box or WRA) and SRU (board or SRA) spares – and ultimately the weapon system – if we do nothing about DMSMS?" From a proactive view, generally speaking, "The SRU that turns 'Red' first is the one that should be examined first".

The OIA methodology is sensitive to the following complex data sets:

- Platform operating hour forecasts

- Failure rates of the LRUs and SRUs

- Obsolescence trend of the system components (if the configuration is full of obsolescence, the greater probability that the LRUs and SRUs which fail will not have repair parts in stock due to their unavailability)

- Number of spares of each type LRU and SRU in the system (with minimum spares, obsolescence-induced shortages could trigger an operations impact sooner)

4.5.1.2. OIA Assumptions. As with any model, there are simplifications – no model can completely capture a human process, such as responding to DMSMS problems. We assume that, without intervention, every year there would be more failed SRU returns that would not get repaired since the failed parts were obsolete, non-procurable, and not in the repair parts stock. When the depot would be unable to repair some of these SRUs (assuming that the obsolete component is also non-available), we would have a problem. This results in a "Red".

The OIA methodology assumes that some obsolete parts could be reclaimed from a pool of non-reparable SRU carcasses. This pool is a source of reclaimed parts for the next time an SRU of that type comes in for repair. Because of reclamation problems (see Section 3.4.2, Reclamation, for risk mitigation considerations), the yield of pool parts from this pool will be less than 100%. Eventually the SRU spares pool will become exhausted, causing the effective loss of an LRU spare when used to supply a spare of the needed SRU. The model is sensitive to operational hours and failure rates as mentioned before.

4.5.1.3. OIA Model Updates. As your DMT implements solutions for your obsolete part types, the OIA must be changed to model them. For example, if you have a completed multi-year buy of an obsolete part, that part is carried (in the model) as "available" or "Green" and would not contribute to the depletion of the SRU spares population. This is how the effect of your implementations on operational supportability can be measured.

4.5.1.4. OIA Output. The output of the OIA provides a matrix of SRUs or LRUs on the Y-axis and years on the X-axis that shows the drawdown of the population of SRU or LRU spares to provide parts for repair as described above. Figure 4-4 presents a notional example of an OIA:

Name	Qty SRUs per Acft	Initial Qty SRU Spares	2002	2003	2004	2005	2006	2007	2008
SRU_1	1	1	G 1	G 1	G 1	Y 0	Y 0	Y 0	Y 0
SRU_2	2	0	Y 0	R -1	R -1	R -1	R -2	R -2	R -2
SRU_3	4	0	Y 0	Y 0	Y 0	Y 0	Y 0	Y 0	Y 0
SRU_{11}	1	0	Y 0	Y 0	Y 0	Y 0	Y 0	Y 0	Y 0
SRU_{12}	1	0	Y 0	Y 0	Y 0	Y 0	Y 0	Y 0	Y 0
SRU_{13}	1	0	Y 0	Y 0	Y 0	Y 0	Y 0	Y 0	Y 0
SRU_{14}	1	0	Y 0	Y 0	Y 0	Y 0	Y 0	Y 0	Y 0
SRU_{15}	1	0	Y 0	Y 0	Y 0	Y 0	Y 0	Y 0	Y 0
SRU_{16}	1	1	G 1	G 1	G 1	G 1	G 1	G 1	G 1
SRU_{17}	1	0	Y 0	Y 0	Y 0	Y 0	Y 0	Y 0	Y 0
SRU_{18}	1	0	Y 0	Y 0	Y 0	Y 0	Y 0	Y 0	Y 0
SRU_{19}	1	0	Y 0	Y 0	Y 0	Y 0	Y 0	Y 0	Y 0
SRU_{20}	8	0	Y 0	R -1	R -1	R -1	R -2	R -2	R -2

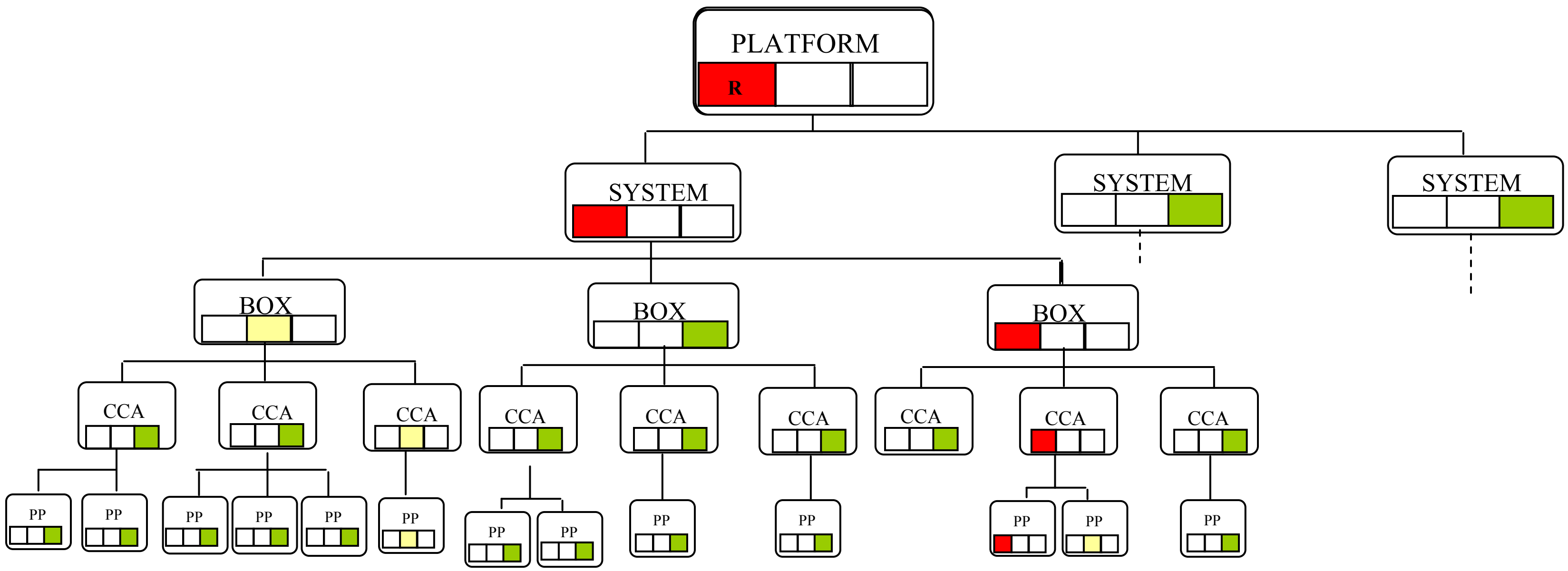
Figure 4-4. Sample OIA Output

The "G1" for SRU_1 in 2002 means the spares posture for SRU_1 is "Green" and there is one spare SRU_1. In 2005, SRU_1 changes to "Y0" because the OIA predicts a draw down of one spare (as described above) leaving a balance of zero spares available for use in repair (posture now "Yellow"). SRU_2 starts out "Y0" (i.e. no spares) and changes to "R-1" when the model indicates a draw down of SRU_2 from 0 to -1, which represents a shortage of one item. Obviously the year in which a given SRU (or LRU, for an LRU table) turns "Red" represents a dire circumstance for the program unless another stopgap or workaround solution is found.

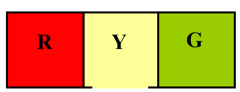
4.5.1.5. Analysis of OIA Results. The legitimate use of the OIA output is to prioritize future obsolescence mitigation projects. The SRU that turns "Red" first is the one that should be examined first. As with the BCA model, the OIA should be updated annually.[7]

4.5.2 Platform Readiness Status

Platform in-commission status is based upon which systems are needed by the operator (tank commander, pilot, ship captain) to successfully complete the mission. In this regard, the status (color coding) of each level is dependent on the status of the indentured box, component, or part below it. This model provides a good Red-Yellow-Green indicator of platform status. An example is shown in Figure 4-5.



CCA = Circuit Card Assembly
PP = Piece Parts



R = Red
Y = Yellow
G = Green

Figure 4-5. Platform Readiness Status

4.5.3 Table of Various Performance Measures

As seen in Table 4-8, there are many useful performance measures available to characterize your DMSMS Management Program effectiveness and output. It may take some time to accumulate the data and capability to produce the more advanced measures listed in Table 4-8 – some of which are quite advanced. "Platform" as used below means the entire weapon system (e.g., the E-3) and a "system" is a Joint Electronic Type Designation (JETD) item (e.g., AN/ARC-171). Systems are composed of multiple subordinate LRUs. [7]

Table 4-8. Typical Performance Measures for a Proactive DMSMS Management Program [7]

Type	Source	Measure	Description
Statistic	Predictive Tool	Platform Health Picture	Monthly count of piece parts across the entire platform by DMSMS color code[1]
		System Health Picture	Monthly count of parts, SRUs, and LRUs by color code, in each system
	DMT DB	PPR Generation	Cumulative generation of PPRs
		LRU Assessment Report Generation	Cumulative generation of LRUs
		PPR Age and Location	Count of PPRs at various DMT locations showing age of PPRs at each location.
		PPRs by Type and Status	Breakout by solution type and status categories
		MYB Solution graphic	Breakout of MYBs by status (e.g., on-order or received)
		"No Impact" Breakdown	Count of "no impact" conclusions
		Funding Picture	Count of funded versus unfunded solutions
		Unfunded Solutions Chart	Breakout of unfunded solutions by age and type
Metric	DMT DB and Plan	PPR Processing Time	Organizational PPR durations versus time standards
	DMT DB and DMEA data	Cost Avoidance	Estimate of proactive solution benefit of established solutions
Advanced Analyses	Multiple sources	Business Case Analysis	Econometric comparison of Proactive and Reactive Approach cases
		Ops Impact Analysis	Projected DMSMS- induced depletion of LRU and SRU spares

[1] A "Green" = part has two or more viable manufacturers, "Yellow"= only one viable manufacturer, "Red" = no manufacturers – the part is obsolete, "Blue" the manufacturing sources for the part are not known.

4.5.4 Design Interface Criteria Evaluation

Evaluation criteria have been developed in the NAVSO P-3692, Independent Logistics Assessment Handbook, that provide assessments for conducting Independent Logistics Assessments (ILAs). Included in Appendix D to this guidebook are some evaluation criteria associated with DMSMS as it relates to design interface. These evaluation criteria can be used as a guide to develop assessment criteria for DMSMS Programs in other acquisition phases.[16]

4.5.5 DMSMS Progress Indicator

As a DMSMS program is established and begins to collect data, ARINC has developed a method to track progress[17]. First and foremost the most important *metric* is mission success. There should be no MICAPS due to a shortage of spares caused by inadequate obsolescence management. In general, it is observed that performance can be determined by the ratio of good events divided by total events. In the field of reliability engineering, basic availability is measured by the ratio of uptime over total time, and is expressed as:

Availability = Uptime ÷ (Uptime + Downtime)

Success in DMSMS management is generally seen in terms of the effect on system availability. Parts availability is itself not measured in terms of uptime or downtime although parts availability contributes to system availability as computed above.

Two equations to measure DMSMS progress have been developed, a macro level at the assembly or box level [Note: Assemblies are equivalent to a Line Replaceable Unit (LRU) or a Weapons System Assembly (WSA)] and a micro level at the piece part level. A measure of progress is determined by calculating the ratio, establishing a baseline and then monitoring it over time. Generally a progress indicator can be measured by funded solutions divided by total potential problems. Note also, that in DMSMS, a solution for an obsolete part has no impact until the solution funding is committed.

At the assembly level (AL) a progress indicator (PI) can simply be stated as:

PI_{AL} = Assemblies with no obsolescence issues ÷ Total number of assemblies (1)

Assemblies with no obsolescence issues imply that the item has been evaluated and will not cause an impact. Some reasons for this include:

- A BOM has been analyzed and either all obsolete problems are solved or there were none.
- Sufficient spares are available based on current and future expected demand
- Board level redesigns or solutions were implemented

Naturally the ratio would have to be re-baselined when system configurations change and the number of total events either decrease or increase. Also from a supply support perspective equation (1) could apply to mechanical assemblies as well.

At the piece part level (PL) a progress indicator (PI) can be stated as:

$PI_{PL} = (G + Y1) \div (G + Y1 + Y2 + R + B)$ (2)

Where:

G = green parts: parts that show no current or future obsolescence or have more than one source of supply

Y1 = yellow parts solved: parts that have only one source of supply and a funded solution has been implemented (or identified if a re-visit or monitoring program is established)

Y2 = yellow parts unsolved: parts that have only one source of supply and no solution has been implemented or identified or no monitoring program has been established

R = red parts: obsolete parts or discontinued parts with no solution identified

B = blue parts: unknown parts not identified by a predictive tool or there is no BOM.

In all cases the values are based on the total number of parts for all assemblies within the system.

For both equation 1 and equation 2 a score of 1.0 is a perfect score and the program has no problems, while a score of 0 (zero) implies obsolescence has not been evaluated. Additional observations for equation 2 include:

- If you do not have any BOM's then you have all blues and will score a Zero.
- If the predictive tool reports greens as red (false positives), that will lower the score
- If the predictive tool reports reds as green, that will falsely increase the score
- If the predictive tool has many blues (unknowns), that will lower the score
- Using the same BOM in different predictive tools could produce different scores
- As problems are solved they move to the numerator which will increase the score

Assemblies with the lowest score would be evaluated in detail thus creating a prioritization. It is recommended that a macro level assessment using equation 1 as a basis be conducted before any detailed piece part evaluation is started. The macro assessment would evaluate the spares posture because of the reminder that if the assembly or subassemblies [Note: Subassembly is equivalent to Shop Replaceable Unit (SRU) or a Shop Replaceable Assembly (SRA)] have sufficient spares or are planned to be replaced then a detailed evaluation may not be needed.

In summary both equations 1 and 2 can be used as progress indicators by collecting your program data, performing the calculation, recording the results, and repeating these steps on a monthly basis. However it is noted that the bottom line still remains, that is, the best metric is mission success.

5 SUMMARY

The DOD DMSMS Guidebook brings together the best proactive practices from across Military Departments and Defense Agencies for managing the risk of obsolescence. You should now have some insight into these key areas:

- How TLCSM and PBL strategies must be developed and integrated to support DMSMS efforts
- Understanding the levels of DMS involvement
- Building a DMSMS Program
- Realizing the benefits of proactive versus reactive approaches to DMSMS
- Awareness of applicable reference documents that provide DMSMS policy and guidance
- Awareness of some of the DMSMS tools that are available
- Awareness of the measurement tools for tracking the status of a DMSMS program and the effectiveness of the efforts
- Awareness of the DMSMS Knowledge Sharing Portal and the helpful resources provided.

The main point that must be taken from this is that the PM needs to actively (and proactively) address DMSMS issues. Doing nothing is not an option. No two programs are alike. However, much can be gained from the prior work of others. The intent of this guide is to help make this action much easier for the responsible PM.

Appendix A

Acronyms

ACAT	Acquisition Category
AFMC	Air Force Materiel Command
AFPD	Air Force Policy Directive
AL	Assembly Level
ALARM	ARINC Logistics Assessment and Risk Management System
ALT	Administrative Lead Time
AME	Advanced Microcircuit Emulation
APU	Auxiliary Power Unit
AQEC	Aerospace Qualified Electronic Component
ASIC	Application Specific Integrated Circuit
BCA	Business Case Analysis
BCR	Benefit to Cost Ratio
BEP	Break Even Point
BOM	Bill of Materials
CAGE	Commercial and Government Entity
CCA	Circuit Card Assembly
CDMD-OA	Configuration Data Manager's Database-Open Architecture
CDR	Critical Design Review
CLM	Continuous Learning Module
CLS	Contractor Logistics Support
CM	Configuration Management
	Continuous Modernization
CoP	Community of Practice
COTS	Commercial Off-the-Shelf
CRG	Case Resolution Guide
CSTEA	Chief of Staff Team Excellence Award
DAASC	Defense Automatic Addressing System Center
DAG	Defense Acquisition Guide
DAMES	DAASC Automated Message Exchange
DAU	Defense Acquisition University
DB	Data Base
DDP	Design Data Package
DESEX	Defense Supply Expert
DFAR	Defense Federal Acquisition Regulation
DKSP	DMSMS Knowledge Sharing Portal
DL	Distance Learning
DLA	Defense Logistics Agency
DLIS	Defense Logistics Information Service
DMEA	Defense Microelectronics Activity
DMP	DMSMS Management Plan
DMSMS	Diminishing Manufacturing Sources and Material Shortages

Appendix A

Acronyms

DMT	DMSMS Management Team
DMT DB	DMSMS Management Team Data Base
DOD	Department of Defense
DODD	Department of Defense Directive
DODI	Department of Defense Instruction
DPAS	Defense Priorities and Allocations System
DSPO	Defense Standardization Program Office
DRMS	Defense Reutilization and Marketing Service
DSCC	Defense Supply Center Columbus
DSS	Distribution Standard System
EA	Evolutionary Acquisition
ECP	Engineering Change Proposal
EDI	Electronic Data Interchange
EMALL	Electronic Mall
FFF	Form, Fit, Function
FOC	Fully Operating (Operational) Capability
FRP	Full Rate Production
FYDP	Five-Year Defense Plan
GEIA	Government Electronics and Information Technology Association
GEM	Generalized Emulation of Microcircuits
GFM	Government Furnished Material
GIDEP	Government Industry and Data Exchange Program
GPS	Global Positioning System
GTN	Global Transportation Network
HMO	Health Management Organization
IAW	In Accordance With
ICS	Interim Contractor Support
IDDE	Integrated Digital Data Environment
IFC	Integrated Framework Chart
IHS	Information Handling System
ILA	Independent Logistics Assessment
INFO	Formerly known as Identification, Notification, and Flagging Operation, now only known as "INFO"
IOC	Initial Operational Capability
IOTE	Initial Operational Test and Evaluation
IPB	Illustrated Parts Breakdown
IPT	Integrated Product Team
IT	Information Technology
ITV	In Transit Visibility

Appendix A

Acronyms

JEDMICS	Joint Engineering Data Management Information and Control System
JETD	Joint Electronic Type Designation
JMPAB	Joint Material Priorities and Allocation Board
JTAV	Joint Total Assessment Visibility
LOG CoP	Logistics Community of Practice
LOGPARS	Logistics Planning and Requirements System
LOGSA	Logistics Support Activity
LOLA	Logistics On-Line Access
LOT	Life-of-Type
LRIP	Low-Rate Initial Production
LRU	Line Replaceable Unit (equivalent to WRA, or box)
MEDALS	Military Engineering Data Asset Location System
MICAP	Mission Capable
MIL SPEC	Military Specification
MOA	Memorandum of Agreement
MTBF	Mean Time Between Failures
MYB	Multi-Year Buy
NAVICP	Naval Inventory Control Point
NAVSEA	Naval Sea Systems Command
NDI	Non-Developmental Item
NHA	Next Higher Assembly
NLP	Navy Logistics Productivity
NRE	Non-Recurring Engineering
NSN	National Stock Number
ODR	Obsolescence Data Repository
OEM	Original Equipment Manufacturer
OIA	Operations Impact Analysis
OMIS	Obsolescence Management Information System
OPR	Office of Primary Responsibility
O&S	Operations and Support
OSA	Open Systems Architecture
OSD	Office of the Secretary of Defense
OSS&E	Operational Safety, Suitability, and Effectiveness
PBL	Performance Based Logistics
PEM	Program Element Monitor
PI	Progress Indicator
PIA	Program Integrating Agent
PL	Piece Part Level
PLT	Production Lead Time
PM	Program Manager

Appendix A

Acronyms

POM	Program Objective Memorandum
PP	Piece Part
PPL	Problem Part List
PPR	Problem Parts Report
PSI	Product Support Integrator
RE	Reverse Engineering
REMIS	Reliability and Maintainability Information System
RFP	Request for Proposals
ROI	Return On Investment
ROM	Rough Order of Magnitude
SDOE	System Design for Operational Effectiveness
SDW	Shared Data Warehouse
SE	Systems Engineering
SLEP	Service Life Extension Program
SMART	Supportability Management Assessment Report Tool
SOE	System Operational Effectiveness
SOS	Source of Supply
SRA	Shop Replaceable Assembly
SRU	Shop Replaceable Unit (equivalent to SRA, e.g., a circuit board)
TARDEC	Tank-Automotive Research, Development, and Engineering Center
TDP	Technical Data Package
TLCSM	Total Life Cycle Systems Management
TLS	Total Logistics Support
TOC	Total Ownership Cost
VECP	Value Engineering Change Proposal
VHDL	VHSIC Hardware Descriptive Language
VHSIC	Very High Speed Integrated Circuit
Web REQ	Web Requisition
Web VLIPS	Web Visual Logistics Information Processing System
WG	Working Group
WRA	Weapons Replaceable Assembly
WSA	Weapon System Assembly
XML	eXtensible Markup Language

Appendix B

Contract Language Examples

This appendix provides examples of contract language that has proven useful in implementing DMSMS programs.

Naval Inventory Control Point (NAVICP) has provided a standard set of clauses to be used in their PLB contracts. The first paragraph assigns all responsibilities of obsolescence management to the contractor. The second paragraph asks the contractor to provide a plan of what he proposes to do to meet his responsibilities. These clauses state:

- The Contractor is responsible for managing obsolescence over the entire period of the contract, and notwithstanding any obsolescence issues or problems, the Contractor remains responsible for meeting all performance and other requirements of this contract. This obsolescence management responsibility includes an ongoing review and identification of actual and potential obsolescence issues, including but not limited to obsolescence of components, assemblies, sub-assemblies, piece parts, and material (hereafter referred to for purposes of this section only as "parts and/or material"). The Contractor is responsible for all costs associated with obtaining a replacement if and when any parts and/or material become obsolete. The costs for which the Contractor is responsible include, but are not limited to, the costs of investigating part availability, interchangeability and substitutability, locating part replacement, vendor interface, engineering efforts, testing requirements, internal drawing changes, etc. The Contractor shall prevent any additional costs from being incurred by the Government due to obsolescence. Any configuration changes due to obsolescence shall be approved in accordance with the Configuration Management requirements of this SOW. The contractor shall provide the Government with obsolescence status briefs, as part of the periodic program reviews provided for under the contract.

- The Contractor shall develop and submit as part of its proposal (with an advance copy supplied to the Government at time of cost estimate submission), an Obsolescence and DMSMS Management Plan for managing the loss, or impending loss, of manufacturers or suppliers of parts and/or material required for performance of this contract. This plan will also address DMSMS Management. At a minimum, the plan shall address the following:

    - Means and approach for providing the Government with information regarding obsolescence and DMSMS issues
    - Planned resolution of current obsolescence and DMSMS issues
    - Parts list screening
    - Parts list monitoring
    - Processing Government Industry Data Exchange Program (GIDEP) (www.gidep.org) DMSMS Alerts
    - Processing DLA DMSMS Alerts
    - Communication with and availability of information to the government
    - Means and approach for establishing obsolescence and DMSMS solutions
    - Plan for conducting DMSMS predictions

Appendix B

Contract Language Examples

The "Program Manager's Handbook – Common Practices to Mitigate the Risk of Obsolescence", published by the Defense Microelectronics Agency (available online at http://www.dmea.osd.mil/pmhandbook_rev_d.pdf) may be used as a guide in developing the Obsolescence and DMSMS Plan. In lieu of preparing and submitting an Obsolescence and DMSMS Plan, the Contractor may provide an existing plan or existing written processes and procedures for review. ***[Identify applicable obsolescence/DMSMS plan]*** will be in effect for the entire term of the contract, unless otherwise agreed to by the PCO.

Other contract clauses to be considered include:

- The Contractor is responsible for managing obsolescence over the entire period of the contract to ensure compliance with all performance and contract requirements. Responsibility includes all costs associated with locating part replacement, vendor interface, and engineering efforts. The Contractor shall develop a plan for managing the loss, or impending loss, of manufacturers or suppliers of components, assemblies, or materials used in the system. Changes considered necessary by the Contractor to ensure the continued manufacture and/or repair of the equipment shall be made in accordance with the Configuration Management requirements of this SOW. The Contractor's Obsolescence Plan shall include participation in GIDEP

- The Contractor will not be responsible for redesign cost for obsolescence initiatives producing Class I changes. Redesign effort to proceed only after the Contractor has exhausted all options to accomplish engineering efforts for drop in replacement.

- The Contractor's obsolescence program shall prevent impact to contract performance metrics and shall prevent additional costs being incurred by the Government due to obsolescence.

- The Contractor is 100% responsible for all obsolescence issues/problems with regard to the items in the contract, including: managing the loss or impending loss of manufacturers or suppliers for the spare and repairable items covered under the H-60 PBL Program. The Contractor must manage obsolescence issues/problems in order to prevent impact to contract performance metrics. Cost related to obsolescence issues/problems will be borne by the Contractor during the life of the contract. Changes considered necessary by the Contractor to ensure the continued manufacture and/or repair of the items will be made in accordance with the Flight Critical Application/Safety of Flight Parts requirements (PWS section 3.2.9) and/or Configuration Management requirements (PWS section 3.4.4.5).

- The Contractor, on a continuous basis during contract performance, shall review and identify obsolescence issues related to piece parts for the items listed in Attachment "X". The Contractor shall be responsible for piece part acquisition of replacement items to avoid obsolescence or repair turnaround issues. Should obsolescence or DMS issues occur that preclude the contractor from obtaining spares of the current design for any vendor repairable item, as identified in Attachment "X", any redesign, qualification and

> production efforts will be considered “over and above” this statement of work. Such issue shall relieve the contractor from availability for that item. The Contractor will perform an engineering analysis of these items and provide recommended solutions. If in the course of an engineering review of the items in Attachment “X”, the Contractor identifies other obsolescence issues concerning the end item test sets, the contractor may notify the government of these issues and possible remedies.

In addition to the above clauses the government should ensure that all contracts encourage the Contractor to share obsolescence resolution data with GIDEP, the DKSP, and the Shared Data Warehouse Obsolescence Data Repository (ODR). As a measure that obsolescence management is being effectively performed the Contractor should also provide case resolution metrics (see Section 4.0 of this Guidebook). In all cases sufficient BOMs and parts lists should be made available to the Government as needed to verify potential engineering change proposals or to verify if Government resources could solve a problem. In summary, all decisions related to the resolution of any DMSMS problem part shall be documented and the government shall be invited to participate in all decisions.

If a Contractor is not tasked to perform the obsolescence management activities, where it may not be cost effective for many legacy systems, then the Contractor should have clauses to provide BOMs (see Section 3.3 of this Guidebook). This will be crucial to the Government organic resources or third-party contractors in objectively performing the obsolescence management activities.

Appendix C

Assessment of DMSMS Resolution Alternatives

Assessment of DMSMS Resolution Alternatives [6]

DMSMS CASE RESOLUTION GUIDE - RESOLUTION ALTERNATIVES

Analysis to determine the most cost-effective resolution shall include consideration for implementation of performance based requirements and migration to Open Systems Architecture to minimize the potential of future impacts during the system or end-items predicted life.
The following table details considerations for evaluating the fit of each option against the case in progress.

Assessment of DMSMS Resolution Alternatives

Resolution Alternative	Non-Recurring Cost Impact	Recurring Cost Impact	Schedule Impact	Lasting Effect - Performance of Action - How long will that action be effective?
1. Encourage existing source to continue production.	Low, could involve premium.	Potentially higher.	Minimal.	• Temporary unless source is provided a long term forecast of market viability.
2. Find alternative source.	Potentially higher.	Could require requalification.	Potentially lengthy.	• Temporary if market condition for alternate source is the same as for initial source. • Potentially long term if alternate is also used on other products. Combined demands could lengthen market viability.
3. Substitute part (same Form, Fit, Function).				
• Obtain existing substitute item.	Low, but could require requalification.	Low.	Minimal impact, if available.	• Temporary if market condition for alternate source is the same as for initial source. • Potentially long term if substitute is also used on other products. Combined demands could lengthen market viability.
• Obtain existing substitute item (de-rated)	Potentially high. Could require requalification	Low.	Potentially high impact if requalification prior to procurement required.	• Temporary if market condition for alternate source is the same as for initial (preferred) source. • Potentially long term if substitute is also used on other products. Combined demands could lengthen market viability.
4. Redefine / tailor military specification requirements.	Minimal. Could require limited qualification.	Low.	Minimal.	• Dependent upon the reason for the "obsolescence/non-availability".
5. Emulation technology. (Procudre part with emulated functions, Produce substitute item).	High. Redesign / Requalification.	Minimal.	High impact. Lead time and requalification required.	• Dependent upon the reason for the "obsolescence/non-availability". • If non-available due to market viability - the condition could recur near term. • If due to technology obsolescence, could be a long term fix.
6. Life-of-Type (LOT) Buy / Bridge Buy.	Cost of Inventory only. Risk of downstream obsolescence.	Minimal. Could be lower with higher quantity buy.	Minimal.	• Long term if calculations are correct.

For More Information, Services, and Support on DMSMS Problems - Visit the AFMC DMSMS HUB website at http://www.ml.afrl.af.mil/ib/dpdsp/dmsms.htm

Appendix C

Assessment of DMSMS Resolution Alternatives

DMSMS CASE RESOLUTION GUIDE - RESOLUTION ALTERNATIVES

Assessment of DMSMS Resolution Alternatives				
Resolution Alternative	Non-Recurring Cost Impact	Recurring Cost Impact	Schedule Impact	Lasting Effect - Performance of Action - How long will that action be effective?
7. Change "prime" sources if item uses GFM.	High. Requalification needed.	Low.	High impact. Lead time & requalification required.	• Dependent upon the reason for the "obsolescence/non-availability". • If non-available due to market viability - the condition could recur near term.
8. Reclamation of existing items.	Low.	Low.	Minimal.	• Short term (Cannibalize).
9. Modify or redesign the end item to replace or eliminate.	High.	High.	High Impact.	• Dependent upon the reason for the "obsolescence/non-availability". • If non-available due to market viability - the condition could recur near term.
10. Replace Item.				
• Replace the entire system.	High.	High.	Lengthy.	• Dependent upon the reason for the "obsolescence/non-availability". • If non-available due to market viability - the condition could recur near term.
• Replace NHA.	Varies by case. Requires FFF analysis. May require requalification/ retesting.	Varies by case. Requires FFF analysis. May require requalification or retesting.	Varies. May be long if requalification or retesting needed.	• Could be long term if replaced item has a longer expected life.
• Replace with newer technology.	Varies by case. Requires FFF analysis. May require requalification/ retesting.	Varies by case. Requires FFF analysis. May require requalification/ retesting.	Varies. May be long if requalification or retesting needed.	• If newer technology available, it could increase effect of action significantly and as by-product could enhance functionality and/or performance.
11. Require the using contractor to maintain inventory.	Cost of Inventory only. Risk of downstream obsolescence.	Minimal. Could be lower with higher quantity buy.	Minimal.	• Similar to LOT Buy. • Title III type action.
12. Obtain production warranty.	Low.	Low.	Minimal.	• Title III type action.
13. Reverse Engineering (RE).	High. May require requalification.	Low.	Dependent upon redesign Some.	• Dependent upon the reason for the "obsolescence/non-availability". • If non-available due to market viability - the condition could recur near term.
14. DPA Title I.	Minimal.	Low. May involve premium.	Minimal.	• Temporary.

For More Information, Services, and Support on DMSMS Problems - Visit the AFMC DMSMS HUB website at http://www.ml.afrl.af.mil/ib/dpdsp/dmsms.htm

Appendix D

Design Interface Evaluation Criteria

As explained in Section 4.5.4, the following evaluation criteria from the Navy's ILA Handbook can be used as a guide to develop assessment criteria for DMSMS Programs.[16]

Design Interface			
Evaluation Criteria	Milestone B	Milestone C	Milestone FRP
6. Diminishing Manufacturing Sources and Material Shortages • A formal Diminishing Manufacturing Sources and Material Shortages (DMSMS) program has been established. This should contain a system technology roadmap, initiated at milestone A, that includes the following: — Identification of critical items/technologies. — Identification of emerging technologies. — DMSMS forecast integrated into technology refresh planning. • Technology insertion/refresh, if used to mitigate obsolescence, includes the following: — A formal plan/strategy to specifically identify DMSMS insertion/refresh requirements. — Established intervals agreed to by the program sponsor. — Approved funding plan over the system life cycle for each scheduled insertion/refresh. • DMSMS forecasting/management tools and or service providers have been researched and selected. • Forecasting for obsolescence and product timelines has been conducted and considers: — Product (revisions and generation/technology changes). — Supplier base. — Contract period and life cycle. • On-going review of the parts lists and Bill-Of-Material (BOM) to identify obsolescence/discontinuance issues is conducted. • A strategy for DMSMS design and manufacturing documentation has been developed and considers: — Design disclosed items, including sub-tier hardware indenture levels. — Form fit function/proprietary design items, including sub-tier hardware indenture levels. • The design approach minimized impact of DMSMS by addressing — Open system architecture. — Order of precedence for parts selection. O Use of qualified manufacturers lists parts, particularly for applications requiring extended temperature ranges). O Selection of parts relatively new in their life cycle. O Minimizes use of custom parts. — The requirement for a preferred parts list and parts control prior to detailed design to minimize obsolescence issues. — Identification of shelf and operating life requirements. — Identification of technology life expectancies. • DMSMS Business Case Analysis (BCA) is performed as part of trade-studies to determine return on investment on mitigation actions. • Obsolescence life cycle (versus contract period) mitigation strategy is defined (e.g., life of type buy, reclamation, captive line, emulation, bridge buy, redesign/tech refresh, aftermarket existing stock, substitute/alternate part, chip/die availability and storage). • DMSMS life cycle cost and cost avoidance has been estimated. • Current and out-year budget established/planned based on DMSMS forecast, tracking and mitigation efforts. • Funding shortfalls (appropriation, amount, timing) and impact are identified, prioritized and documented.	X	U	U

Appendix D

Design Interface Evaluation Criteria

Design Interface			
Evaluation Criteria	Milestone B	Milestone C	Milestone FRP
• Contractual data requirements define, as appropriate: — Contractor vs. Government life cycle DMSMS tasks and responsibilities. — DMSMS incentives/awards. — Decision on ownership of product/technical data package rights and COTS licensing agreements. — PBL/TSPR strategy for legacy system DMSMS. — DMSMS planning and mitigation requirements. — System architecture/design to minimize obsolescence costs.. — DMSMS production/repair procurement capability including hardware/software, support and test equipment, tooling/fixtures and chip/die availability and storage. — Supply chain monitoring/management including contractor/vendor notification of pending parts obsolescence and part/firmware changes. — Configuration management to the appropriate obsolescence mitigation levels. — DMSMS database establishment and maintenance through an Integrated Digital Data Environment (IDDE) concept of operations that supports the total life cycle management of the product. — Technical data package that supports the DMSMS mitigation strategy: O Specifications, technical manuals, engineering drawings/product data models that provide appropriate level of detail for reprocurement, maintenance and manufacture of the product. O Special instructions for items such as unique manufacturing, quality and test processes, preservation and packaging. O Very high Speed Integrated Circuit hardware Description Language (VHDL) documentation of digital electronic circuitry. O The version, release change status and other identification details of each deliverable items. — Program, design and production readiness reviews of contractor DMSMS management effectiveness. — Provisioning screening required for maximum use of existing supply items. • DMSMS considerations are incorporated into the integrated logistics support plan and post production support plan • Items that are single source and those for which the Government cannot obtain data rights and the associated corrective action plans are identified. • Strategies to resolve potential DMSMS problems (e.g., production or repair capabilities, software upgrades/maintenance, support equipment) are established. • A program manager/naval supply systems command reprocurement engineering support agreement is in place. • Monitoring a usage of anticipated demand vs. items available for DMSMS mitigation planning throughout the items life cycle.	X ↓	U ↓	U ↓

Appendix E

References

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